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ABSTRACT

Participants in the 1998 annual technology conference of the Council of Educational Facility Planners, International discussed adapting today's school buildings to meet the new educational technology. This document presents the presentation materials (mostly copies of slides or transparencies, with little or no accompanying text) delivered by speakers at the conference. Each presenter addressed the overall subject of the classroom of the future and explored such topics as educational technology planning, developing computer and video infrastructures, educational technology costs, hardware considerations, and bidding and purchasing of technology. (GR)

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CEFPI's 1998 Technology Conference
Preparing Your School Building for Technology

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CEFPI THANKS
THE TECHWEST 1998 EXHIBITORS
FOR THEIR GENEROSITY IN
DISPLAYING THE

CLASSROOM OF THE FUTURE

INTERIOR CONCEPTS

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RAULAND-BORG CORPORATION

ZENITH ELECTRONICS

TECHWEST 1998 EXHIBITORS

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Ben Casados

Preparing Your School Buildings for Technology

The Council of Educational Facility Planners, International is fortunate to have wonderful resources within its membership—people whose knowledge, understanding, and experience in educational facility development is unmatched worldwide. It is with great pride and gratitude that we thank the following outstanding CEFPI members and other professionals who have shared their expertise as presenters at our annual Technology Conference.

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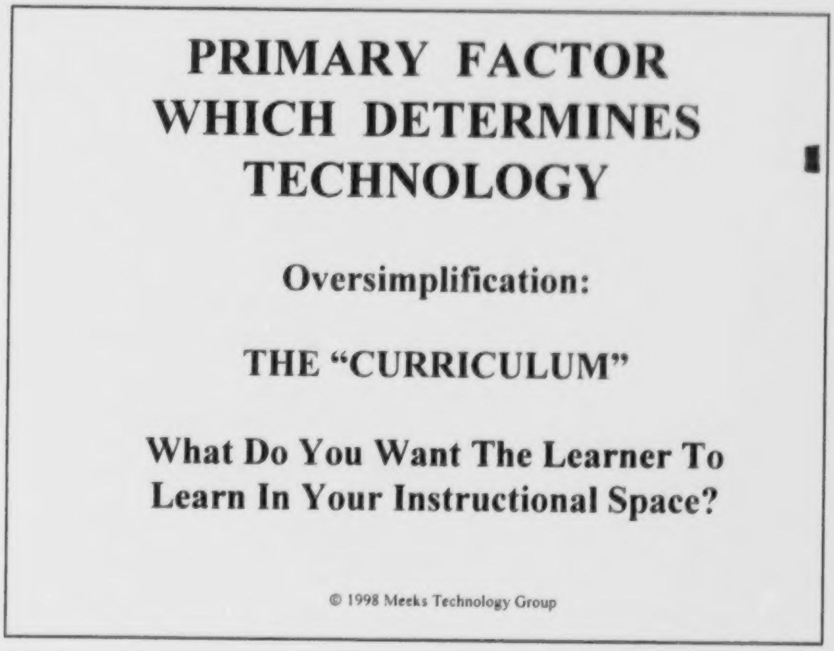
MAXIMIZING YOUR PURCHASING DOLLARS.

HOW DO YOU DETERMINE THE TECHNOLOGY WHICH WORKS FOR YOUR INSTRUCTIONAL SPACE?

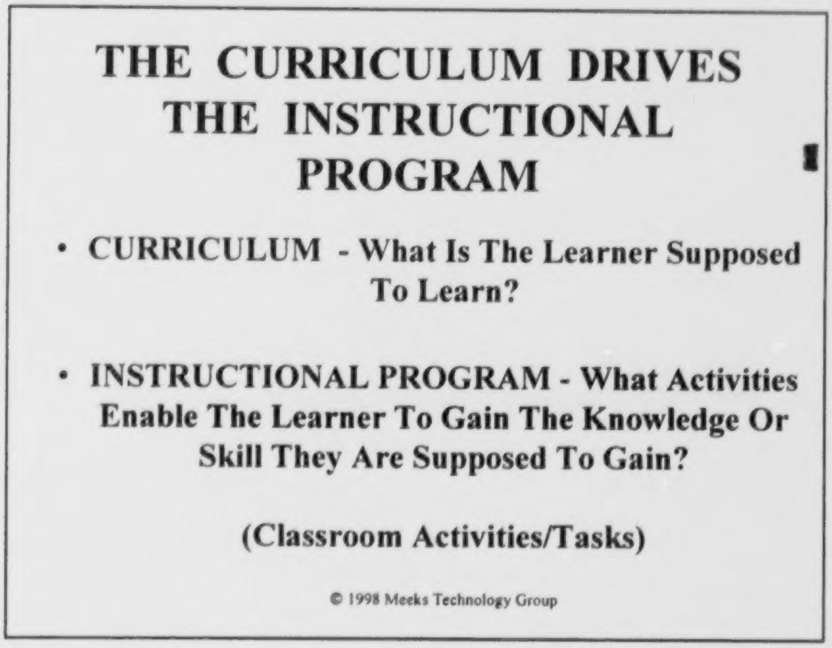


PRIMARY FACTOR WHICH DETERMINES TECHNOLOGY

Oversimplification:

THE "CURRICULUM"

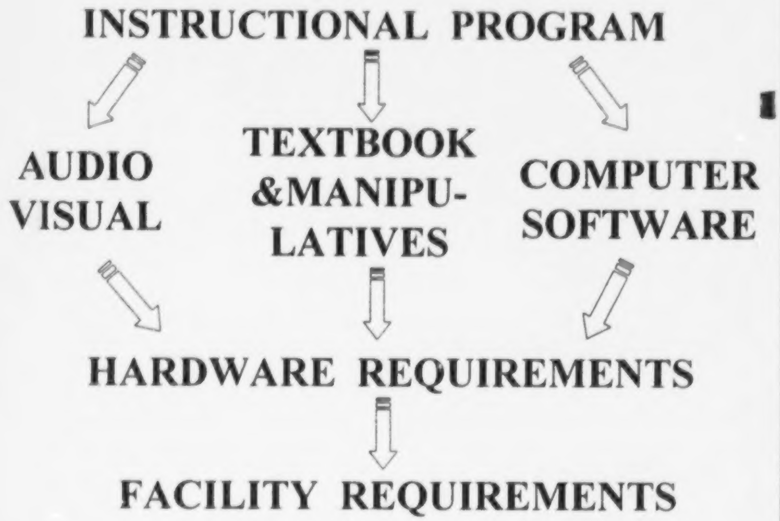
What Do You Want The Learner To Learn In Your Instructional Space?



THE CURRICULUM DRIVES THE INSTRUCTIONAL PROGRAM

- **CURRICULUM - What Is The Learner Supposed To Learn?**
- **INSTRUCTIONAL PROGRAM - What Activities Enable The Learner To Gain The Knowledge Or Skill They Are Supposed To Gain?**

(Classroom Activities/Tasks)



INSTRUCTIONAL PROGRAM

AUDIO VISUAL

TEXTBOOK &MANIPULATIVES

COMPUTER SOFTWARE

HARDWARE REQUIREMENTS

FACILITY REQUIREMENTS

SECOND PRIMARY FACTOR WHICH DEFINES TECHNOLOGY

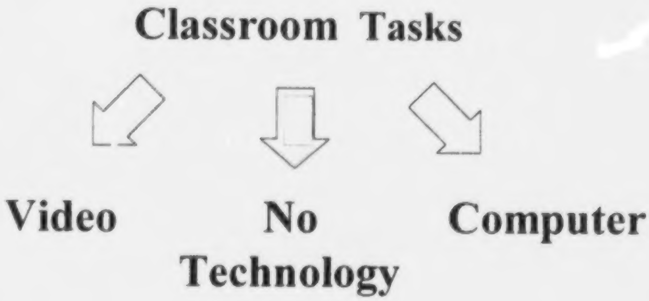
INFORMATION DELIVERY CATEGORIES

How Many Learners Will Receive the Same Information At the Same Time?

INFORMATION DELIVERY CATEGORIES

- **Workstations**
  One To Three People
- **Work Groups**
  Six To Eight People Utilizing Workstations Simultaneously / Interactively For A Project
- **Presentation Systems**
  Information Presentation To Ten Or More People

SPECIFIC TECHNOLOGIES LEND THEMSELVES TO SPECIFIC TASKS



Classroom Tasks

Video

No Technology

Computer

THIRD PRIMARY FACTOR WHICH DEFINES TECHNOLOGY

Do You Intend To Move The Learner To The Site of The Knowledge Base?

VERSUS

Do You Desire To Move The Knowledge Base To The Site Of The Learner?

FACTORS WHICH INFLUENCE TECHNOLOGY FROM USERS VIEWPOINT

- **Must Be Easy To Use**
- **Must Be Readily Available**
- **Must Improve Existing Method Of Doing Things**
- **There Must Be A Large Users Group Ready To Adopt The Use Of Technology**

THIS VIEWPOINT IMPLIES THERE SHOULD BE A PLAN.

(Maximizing Purchasing Dollars)

WHAT HAPPENS WHEN A "PLAN" IS NOT IMPLEMENTED?

ISLANDS OF TECHNOLOGY

Various Technologies Are Purchased Independently Of Each Other, Which Are Not Capable Of Communicating With Each Other (Bridges Between The Islands)

Electronic Card
Catalog / Circulation

Satellite And
TV Services

Computer
Network
Computer Labs

Reference
Stations

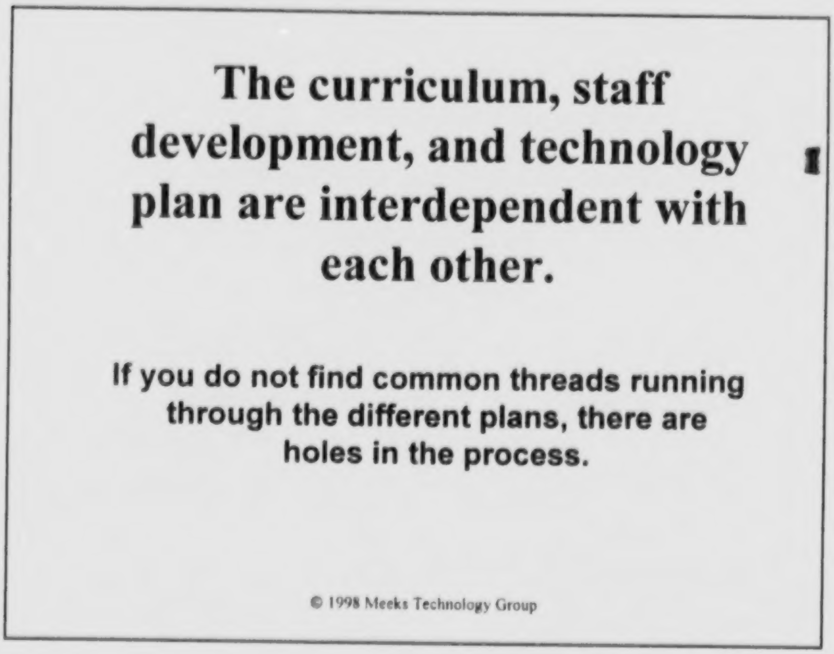
Classroom PC
Administrator PC

Media Retrieval
System

Telephone
System

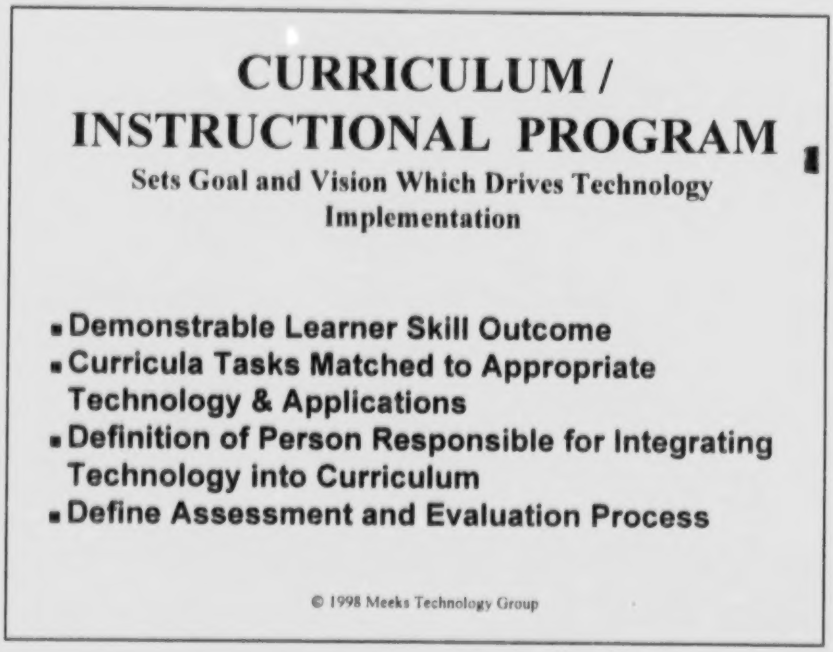
Technology Planning Involves More Than Planning For Hardware and Systems

**Curriculum/Instructional Program,
Staff Development Plans,
Technology Plans**



The curriculum, staff development, and technology plan are interdependent with each other.

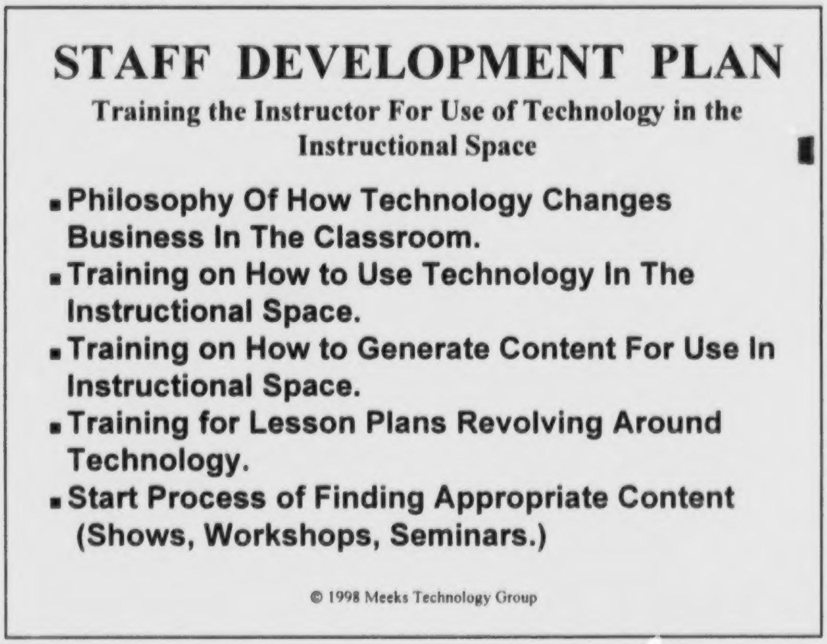
If you do not find common threads running through the different plans, there are holes in the process.



CURRICULUM / INSTRUCTIONAL PROGRAM

Sets Goal and Vision Which Drives Technology Implementation

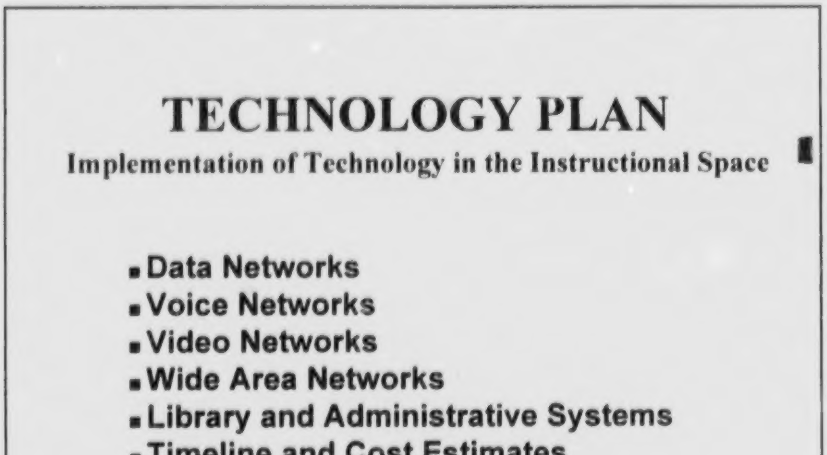
- Demonstrable Learner Skill Outcome
- Curricula Tasks Matched to Appropriate Technology & Applications
- Definition of Person Responsible for Integrating Technology into Curriculum
- Define Assessment and Evaluation Process



STAFF DEVELOPMENT PLAN

Training the Instructor For Use of Technology in the Instructional Space

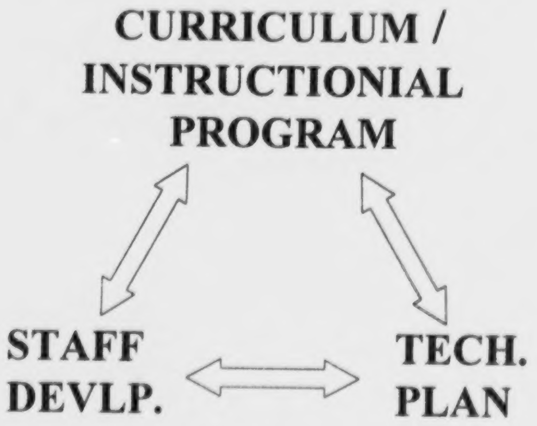
- Philosophy Of How Technology Changes Business In The Classroom.
- Training on How to Use Technology In The Instructional Space.
- Training on How to Generate Content For Use In Instructional Space.
- Training for Lesson Plans Revolving Around Technology.
- Start Process of Finding Appropriate Content (Shows, Workshops, Seminars.)



TECHNOLOGY PLAN

Implementation of Technology in the Instructional Space

- Data Networks
- Voice Networks
- Video Networks
- Wide Area Networks
- Library and Administrative Systems
- Timeline and Cost Estimates



CURRICULUM / INSTRUCTIONIAL PROGRAM

STAFF DEVLP.

TECH. PLAN

PLANS RESONATE WITH EACH OTHER

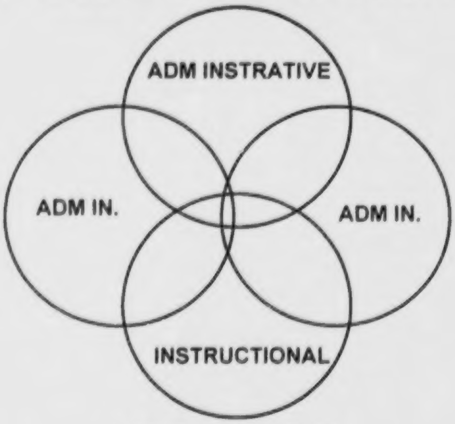
HOW THE PLANS INTERTWINE

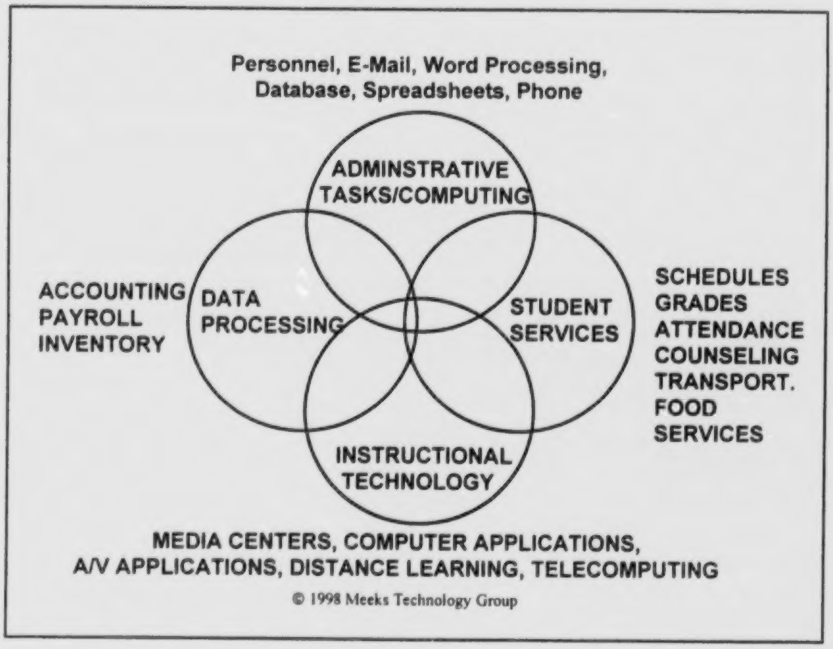
- **What Instructional Task Are You Accomplishing with Technology? (Cur.)**
- **What Courseware Meets Content Requirements? (Cur.)**
- **What Hardware Needs to Be in Place? (Tech.)**
- **What Facility Upgrades are Required? (Tech.)**
- **How Will the Teacher be Trained To Use The New Courseware and Hardware? (Staff Development)**

TECHNOLOGY IN EDUCATION

An Overview

AREAS WHERE TECHNOLOGY IS USED IN EDUCATION





Personnel, E-Mail, Word Processing,
Database, Spreadsheets, Phone

ADMINSTRATIVE
TASKS/COMPUTING

ACCOUNTING
PAYROLL
INVENTORY

DATA
PROCESSING

STUDENT
SERVICES

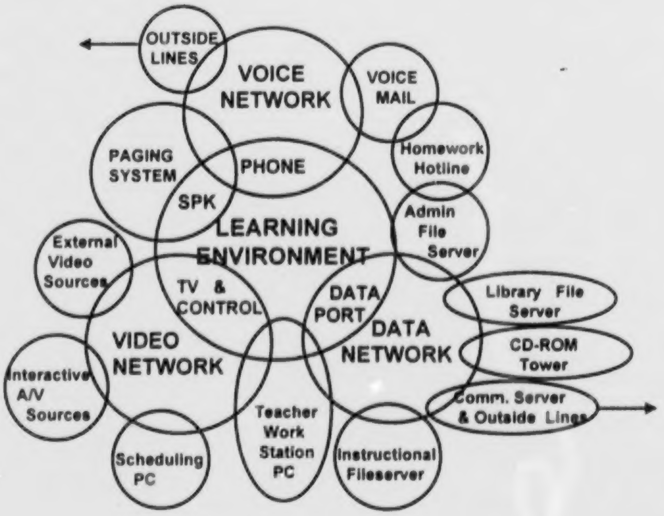
SCHEDULES
GRADES
ATTENDANCE
COUNSELING
TRANSPORT.
FOOD
SERVICES

INSTRUCTIONAL
TECHNOLOGY

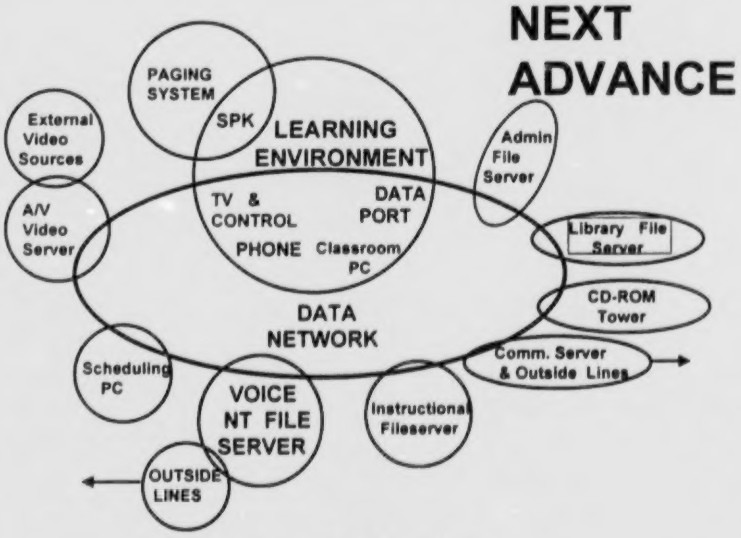
MEDIA CENTERS, COMPUTER APPLICATIONS,
A/V APPLICATIONS, DISTANCE LEARNING, TELECOMPUTING

TECHNOLOGY IN THE CLASSROOM

An Overview

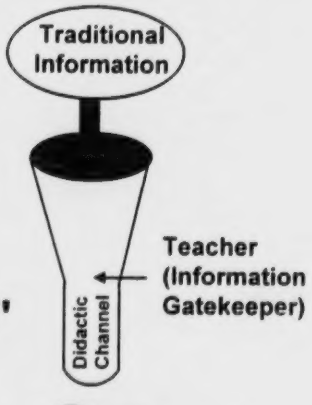


NEXT ADVANCE



DOES TECHNOLOGY IMPROVE THE EDUCATIONAL PROCESS?

THE "OLD DAYS"

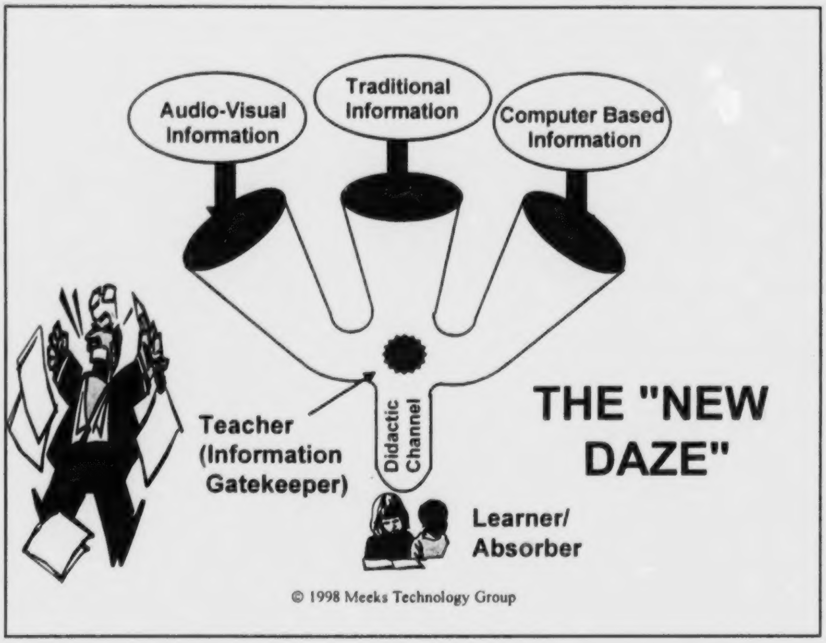


Traditional Information

Didactic Channel

Teacher (Information Gatekeeper)

Learner/ Absorber



Audio-Visual Information

Traditional Information

Computer Based Information

Teacher (Information Gatekeeper)

Didactic Channel

Learner/ Absorber

THE "NEW DAZE"

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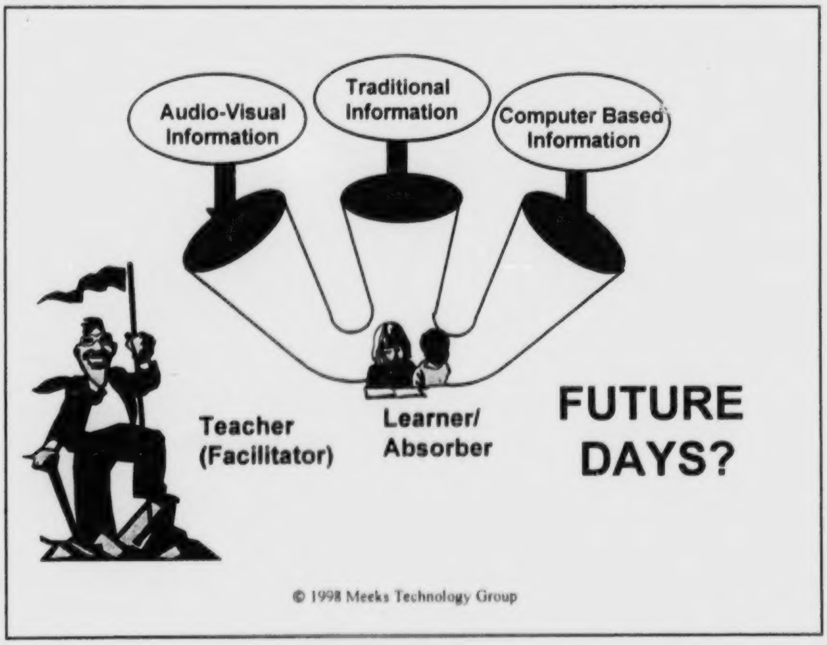

Audio-Visual Information

Traditional Information

Computer Based Information

Teacher (Facilitator)

Learner/ Absorber

FUTURE DAYS?

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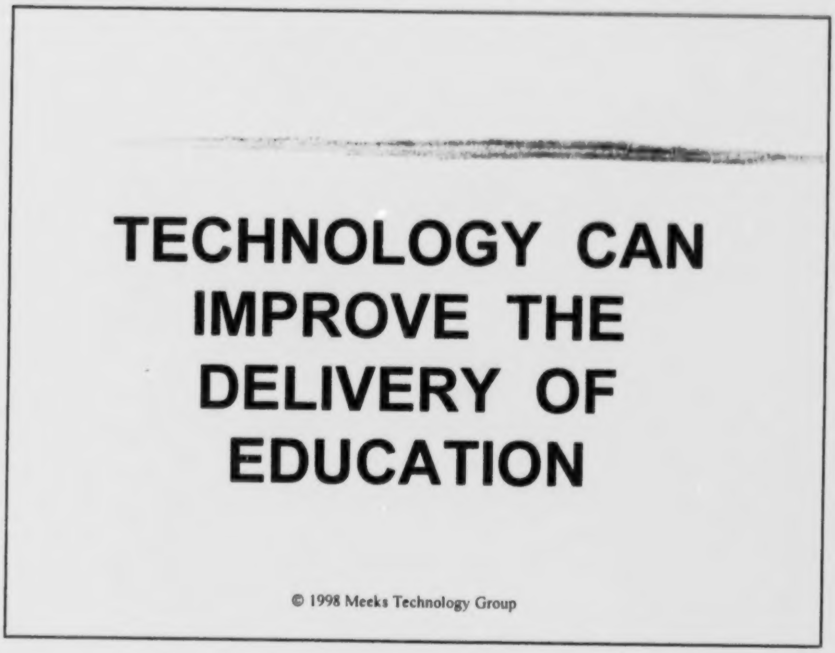
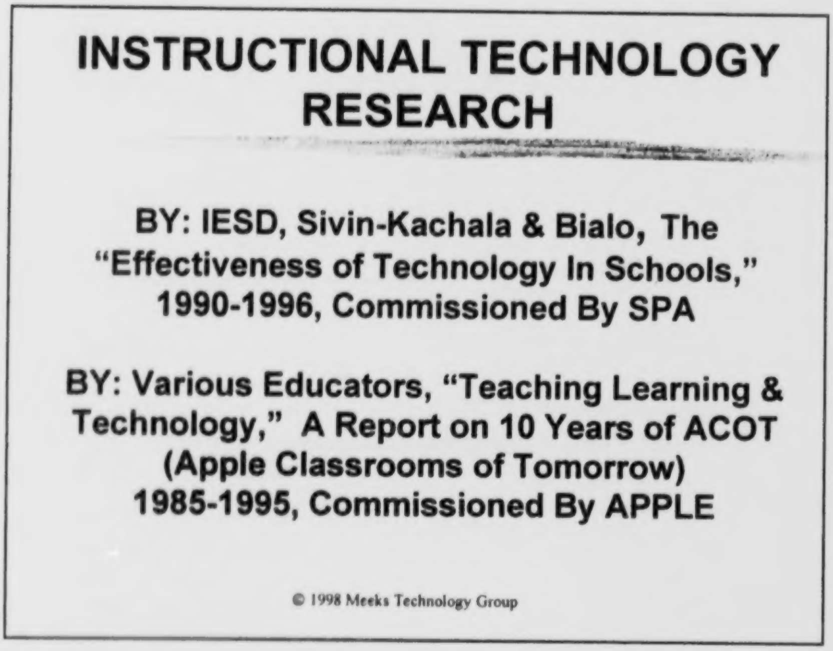


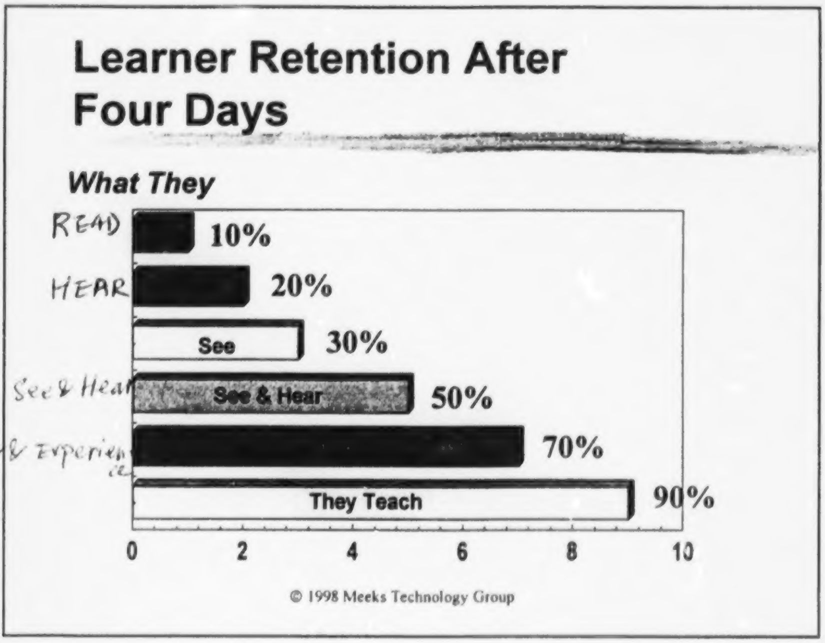
TECHNOLOGY CAN IMPROVE THE DELIVERY OF EDUCATION



INSTRUCTIONAL TECHNOLOGY RESEARCH

BY: IESD, Sivin-Kachala & Bialo, The "Effectiveness of Technology In Schools," 1990-1996, Commissioned By SPA

BY: Various Educators, "Teaching Learning & Technology," A Report on 10 Years of ACOT (Apple Classrooms of Tomorrow) 1985-1995, Commissioned By APPLE



Learner Retention After Four Days

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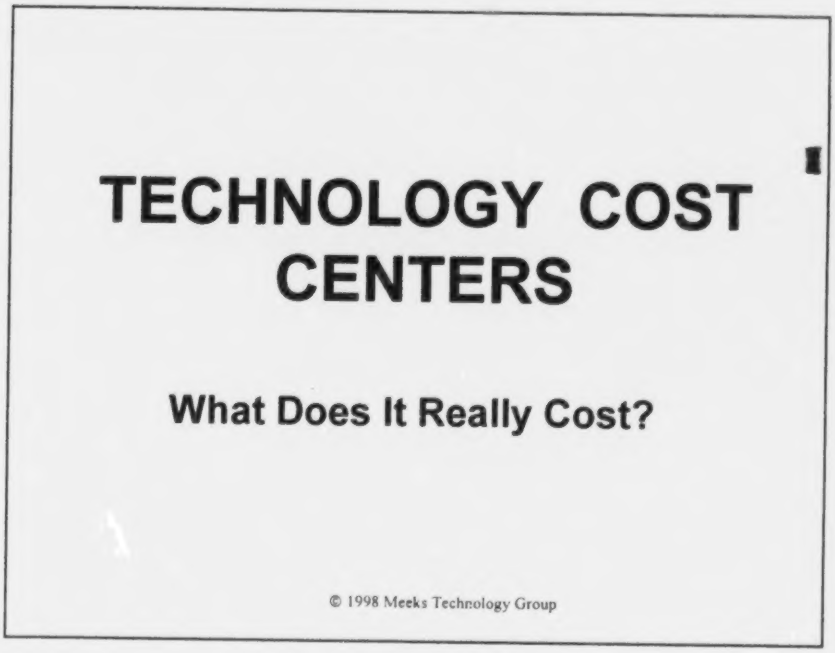
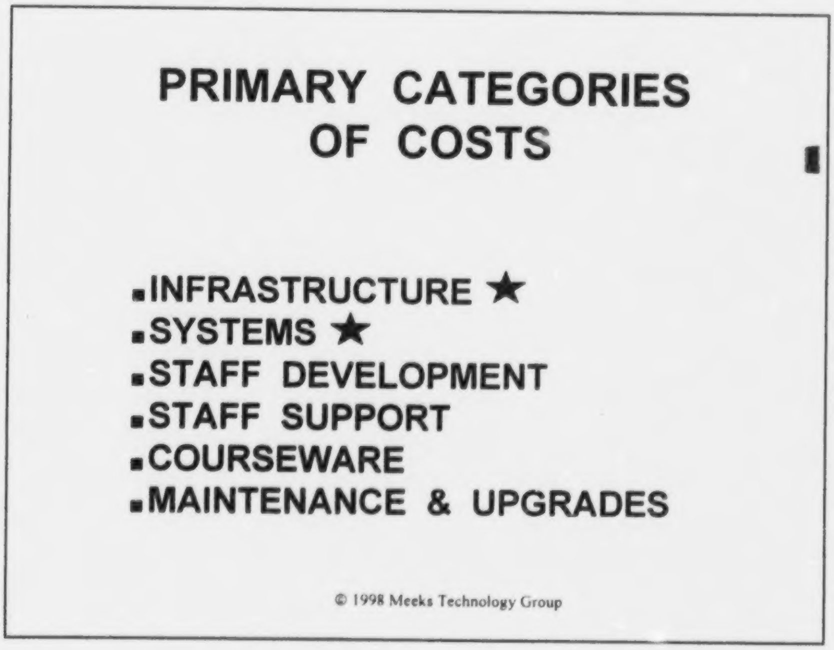


TECHNOLOGY COST CENTERS

What Does It Really Cost?



PRIMARY CATEGORIES OF COSTS

- INFRASTRUCTURE ★
- SYSTEMS ★
- STAFF DEVELOPMENT
- STAFF SUPPORT
- COURSEWARE
- MAINTENANCE & UPGRADES

INFRASTRUCTURE

- TYPICALLY FUNDED AS CAPITAL PROJECT

- Electrical Power Requirements
- Cable Trays & Raceway for Cabling
- Special HVAC Requirements

SYSTEMS & CABLING

- TYPICALLY FUNDED AS CAPITAL PROJECT

- Voice Networks
- Data Networks
- Video Networks
- Special Audio & Video Systems

STAFF DEVELOPMENT

- FUNDED FROM OPERATING BUDGET

- In-Service Training on Technology
- Special Training Activities for Advanced Users (Release Time & Subs)
- Attendance of Regional & National Shows
- Time for Developing Applications
- Special Grant Funds for New Application Development / Experiments

STAFF SUPPORT

- FUNDED FROM OPERATING BUDGET

- Technology Director Dedicated ONLY to Implement Plan - Instructional Focus
- Data Network Administrator
- Technology Technician(s) - Repair & Maintenance
- Building Level Technology Coordinator (Master Teacher?)

COURSEWARE

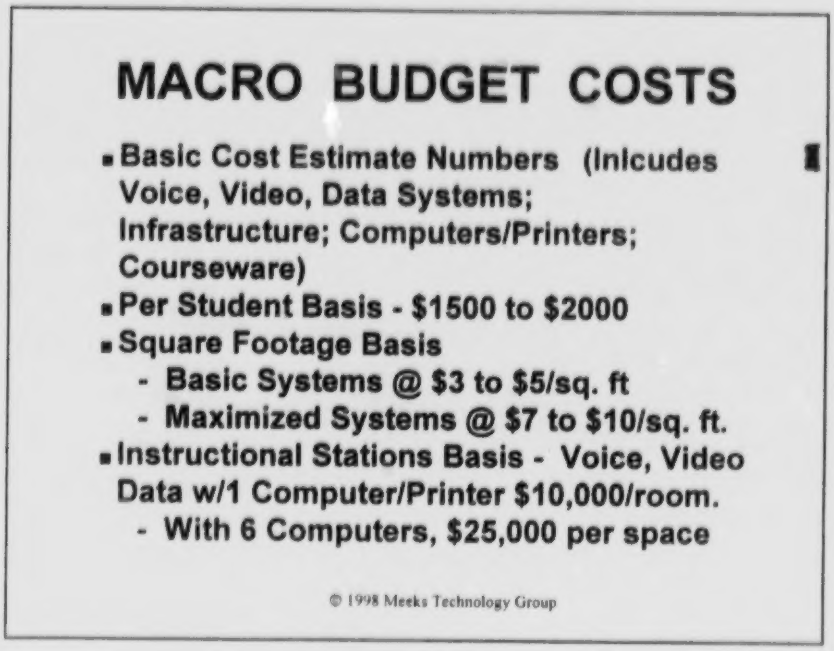
- FUNDED THROUGH CAPITAL PROJECT

- Teacher Productivity Software
- Student Workstation Software
- Computer Lab Applications
- Library Automation Software
- Reference Resources (Computer & A/V)
- Curriculum Specific Software
- Curriculum Specific A/V Media

MAINTENANCE & UPGRADES

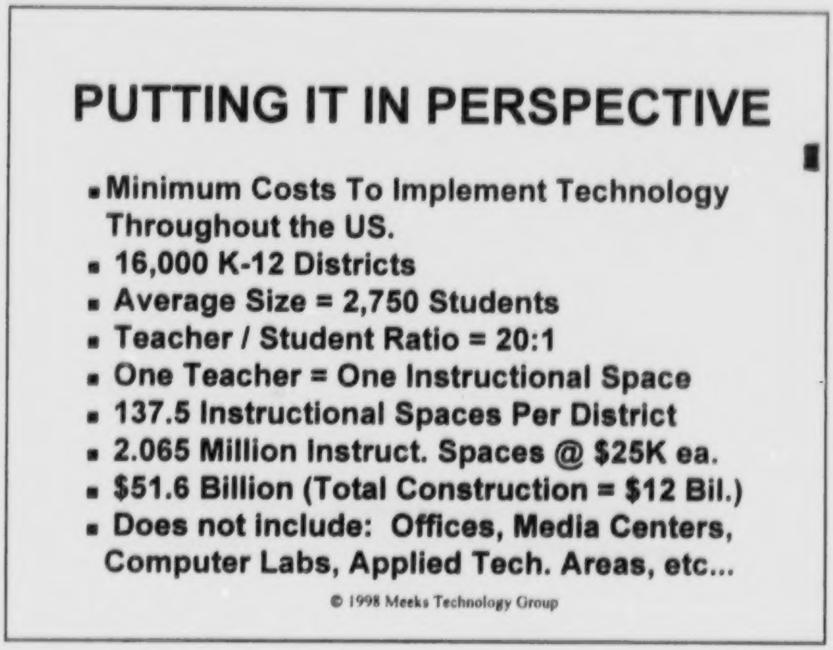
- FUNDED AS LINE ITEM IN YEARLY DISTRICT BUDGET

- Expansion of Video Network Resources (Adding More VCR's, LD's, CD-Is, etc...)
- Expansion of Data Network Resources
- Upgrading Specific Computers for Specific Curriculum Tasks
- Replacing Obsolete Computers, Televisions, etc...



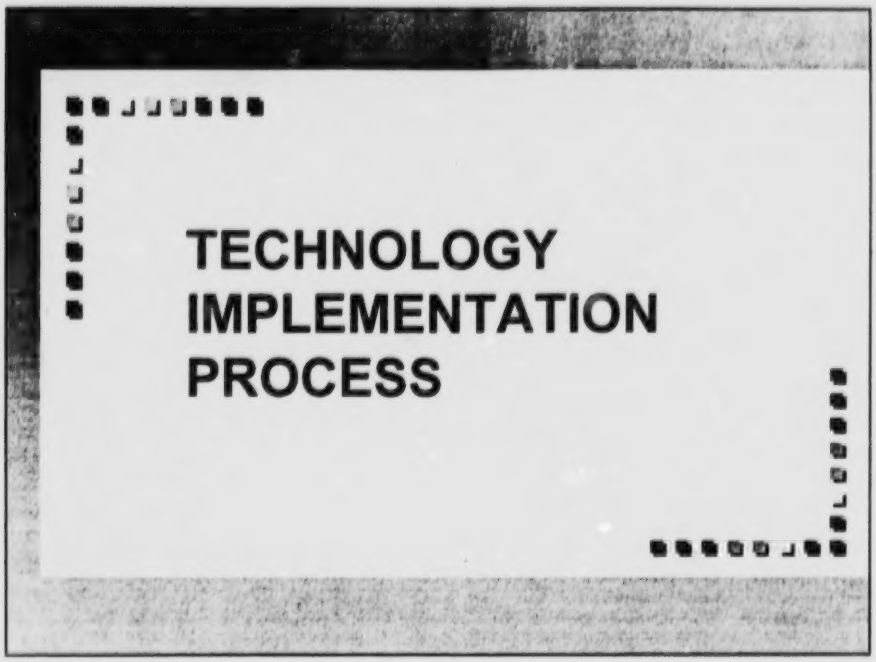
MACRO BUDGET COSTS

- Basic Cost Estimate Numbers (Inlcudes Voice, Video, Data Systems; Infrastructure; Computers/Printers; Courseware)
- Per Student Basis - $1500 to $2000
- Square Footage Basis
  - Basic Systems @ $3 to $5/sq. ft
  - Maximized Systems @ $7 to $10/sq. ft.
- Instructional Stations Basis - Voice, Video Data w/1 Computer/Printer $10,000/room.
  - With 6 Computers, $25,000 per space

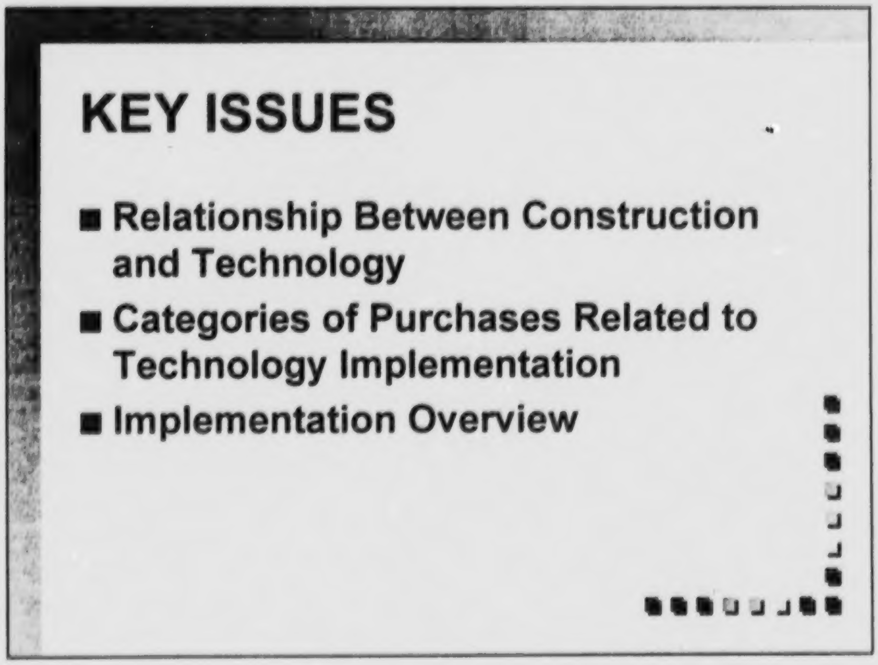


PUTTING IT IN PERSPECTIVE

- Minimum Costs To Implement Technology Throughout the US.
- 16,000 K-12 Districts
- Average Size = 2,750 Students
- Teacher / Student Ratio = 20:1
- One Teacher = One Instructional Space
- 137.5 Instructional Spaces Per District
- 2.065 Million Instruct. Spaces @ $25K ea.
- $51.6 Billion (Total Construction = $12 Bil.)
- Does not include: Offices, Media Centers, Computer Labs, Applied Tech. Areas, etc...

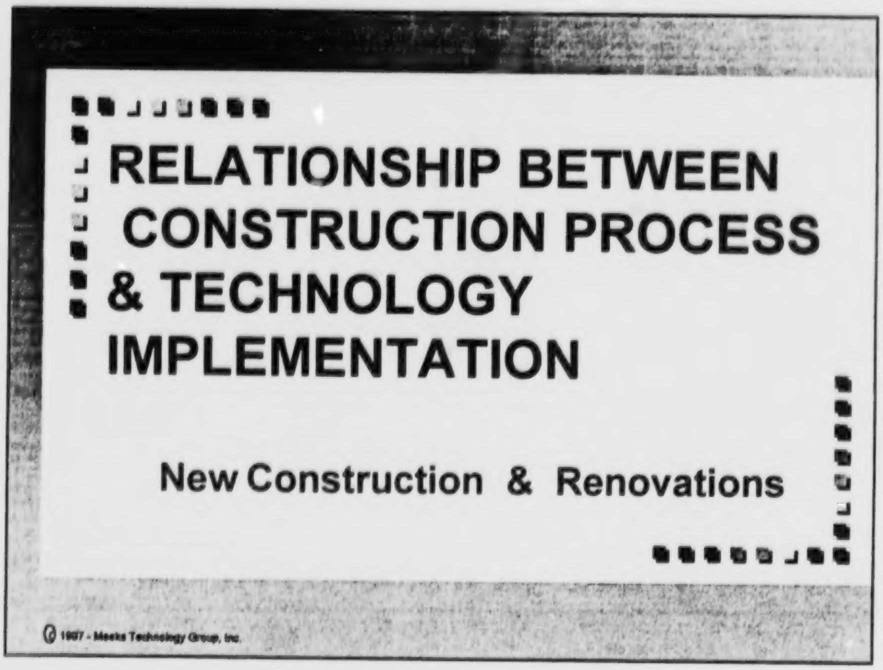


TECHNOLOGY IMPLEMENTATION PROCESS



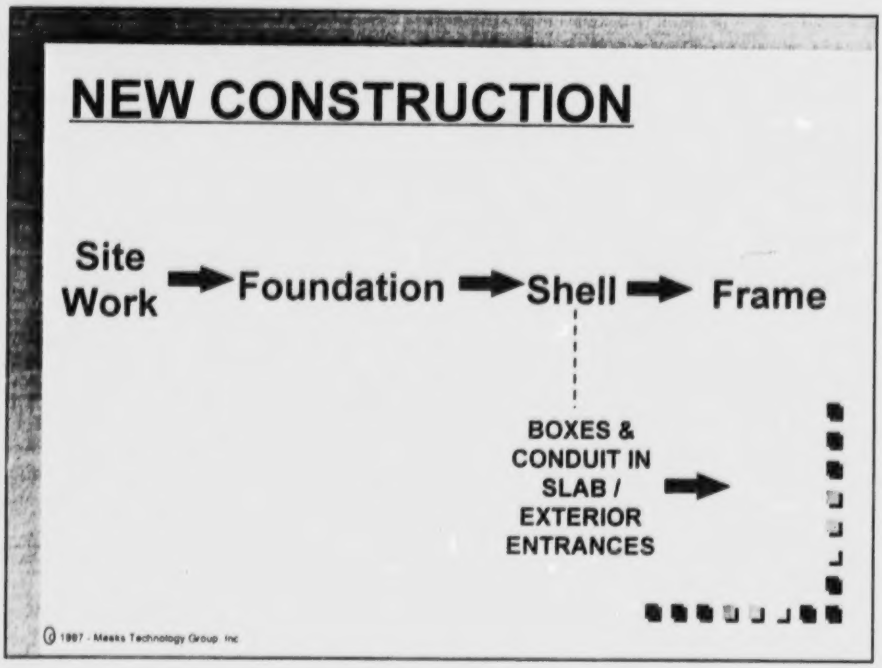
KEY ISSUES

- Relationship Between Construction and Technology
- Categories of Purchases Related to Technology Implementation
- Implementation Overview



RELATIONSHIP BETWEEN CONSTRUCTION PROCESS & TECHNOLOGY IMPLEMENTATION

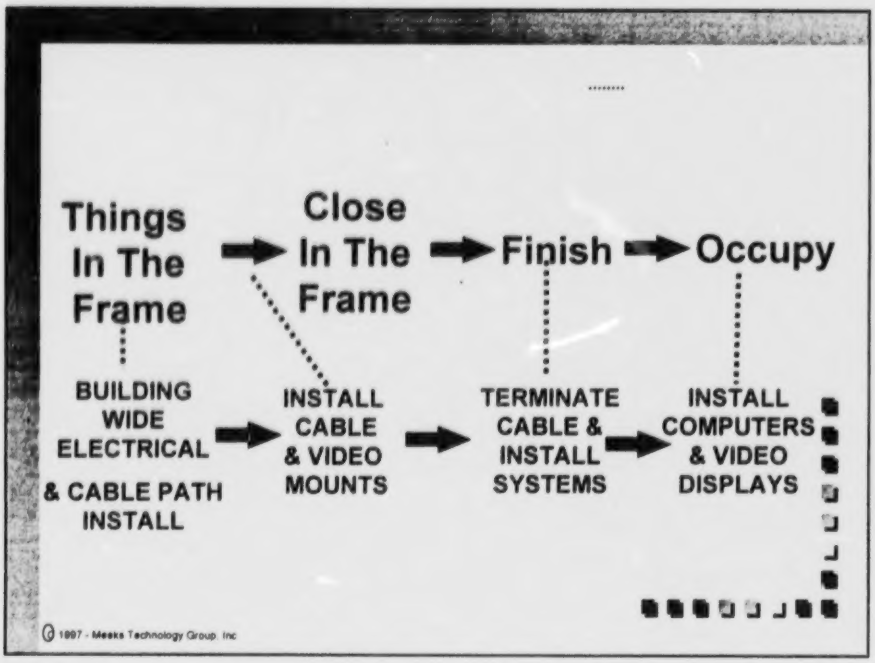
New Construction & Renovations



NEW CONSTRUCTION

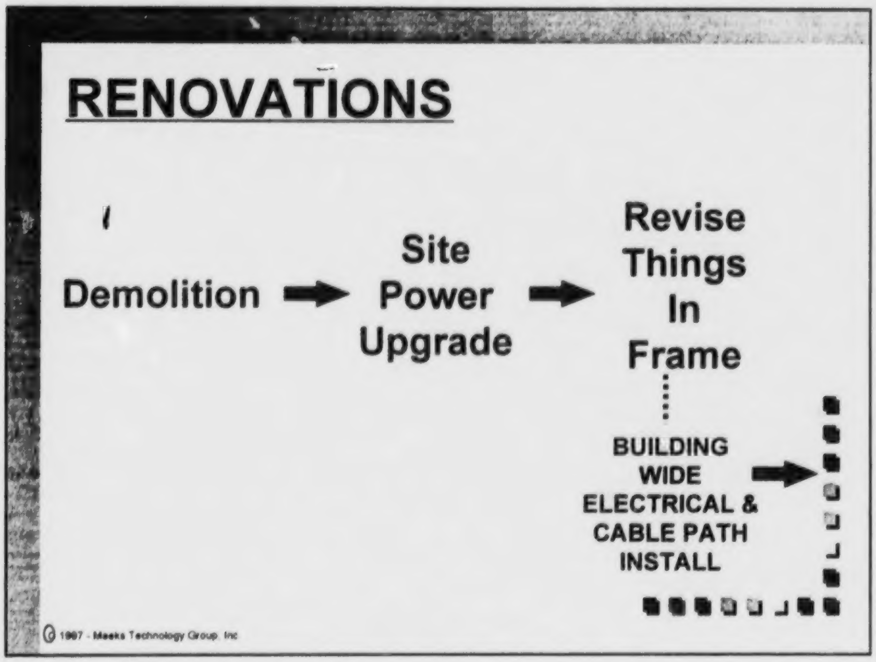
Site Work → Foundation → Shell → Frame

BOXES & CONDUIT IN SLAB / EXTERIOR ENTRANCES →



Things In The Frame → Close In The Frame → Finish → Occupy

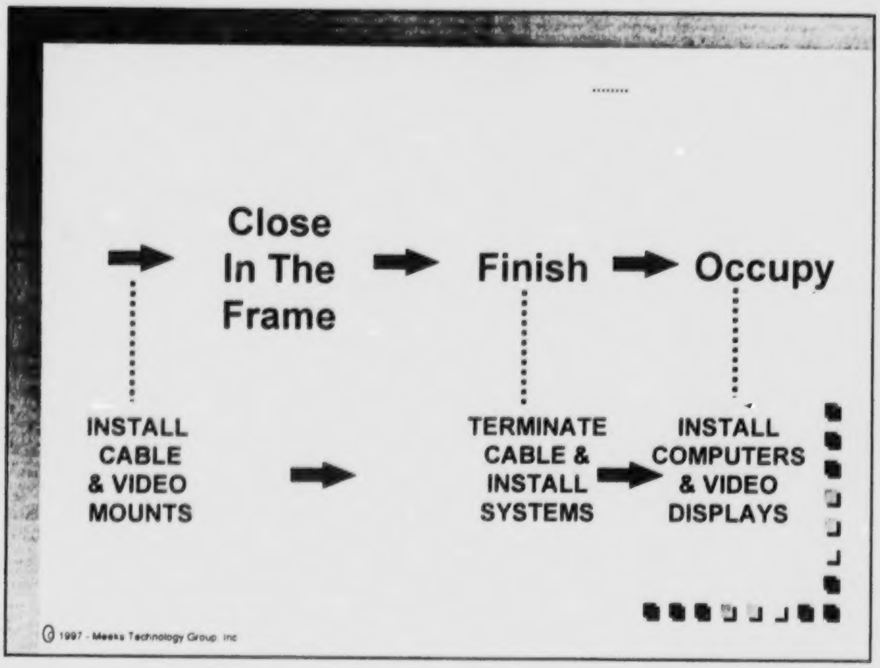
BUILDING WIDE ELECTRICAL & CABLE PATH INSTALL → INSTALL CABLE & VIDEO MOUNTS → TERMINATE CABLE & INSTALL SYSTEMS → INSTALL COMPUTERS & VIDEO DISPLAYS



RENOVATIONS

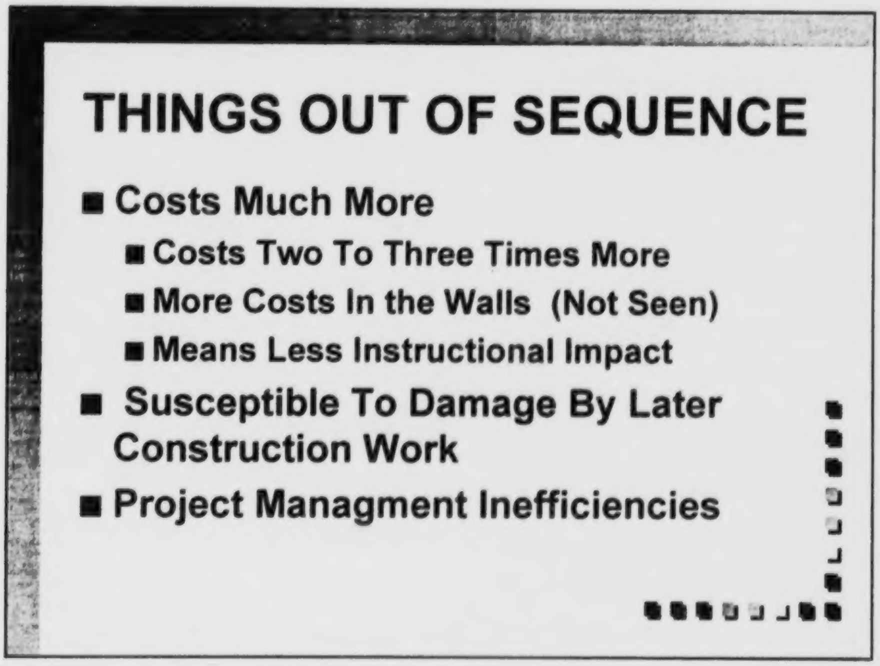
Demolition → Site Power Upgrade → Revise Things In Frame

BUILDING WIDE ELECTRICAL & CABLE PATH INSTALL →



Close In The Frame → Finish → Occupy

INSTALL CABLE & VIDEO MOUNTS → TERMINATE CABLE & INSTALL SYSTEMS → INSTALL COMPUTERS & VIDEO DISPLAYS



THINGS OUT OF SEQUENCE

- Costs Much More
  - Costs Two To Three Times More
  - More Costs In the Walls (Not Seen)
  - Means Less Instructional Impact
- Susceptible To Damage By Later Construction Work
- Project Managment Inefficiencies

PURCHASE CATEGORIES FOR TECHNOLOGY IMPLEMENTATION

PURCHASE CATEGORIES

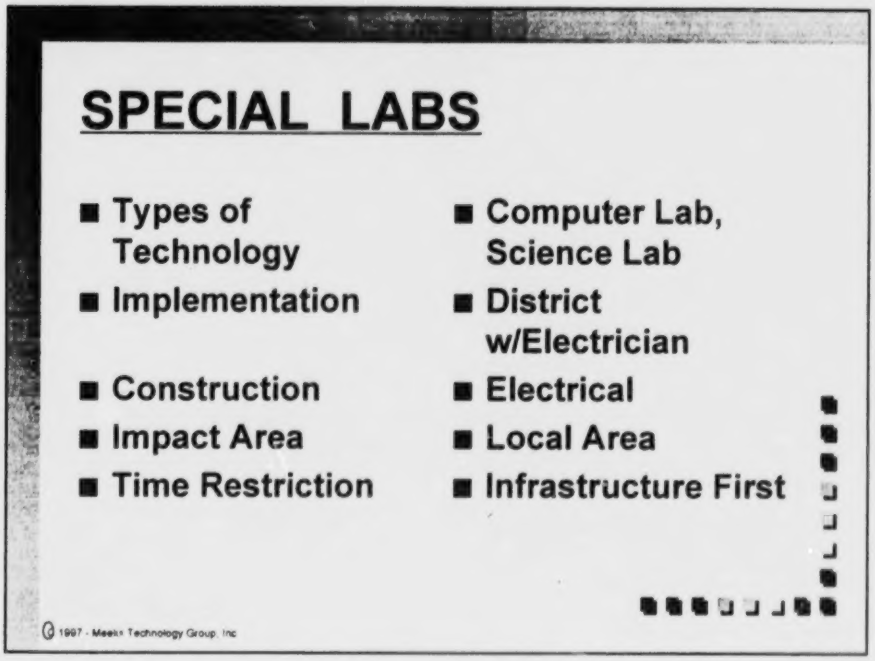
- Upgrade Components
- Replace Obsolete Components
- Special Lab Purchases
- Infrastructure
- Systems and Components

UPGRADE COMPONENTS

Types of Technology	Computer (RAM, Hard Drive, NIC)
Implementation	Direct By District
Construction	None
Impact Area	None
Time Restriction	None

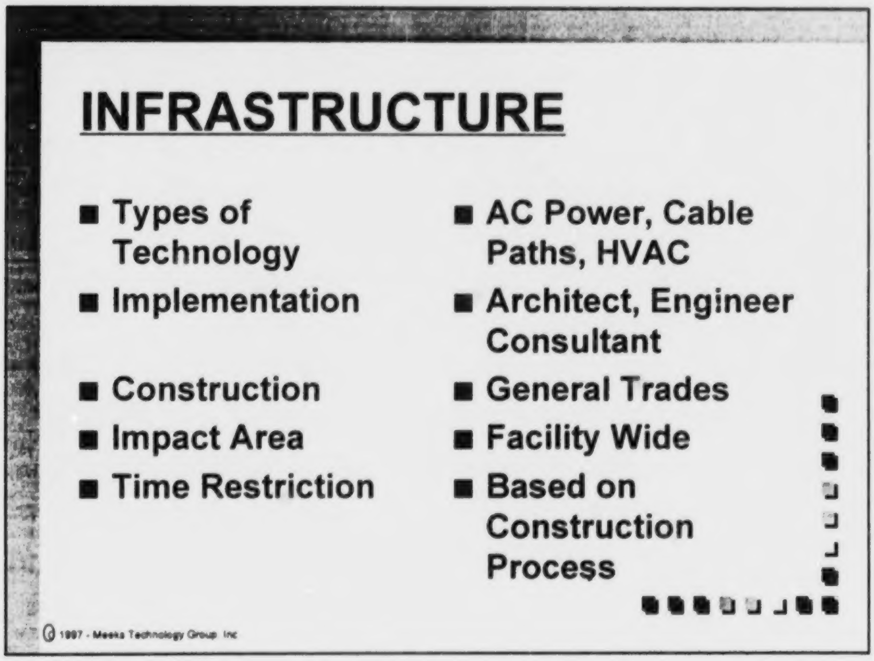
REPLACE OBSOLETE COMPONENTS

Types of Technology	Computer, Printer, Video Display
Implementation	Direct By District
Construction	None
Impact Area	None
Time Restriction	None



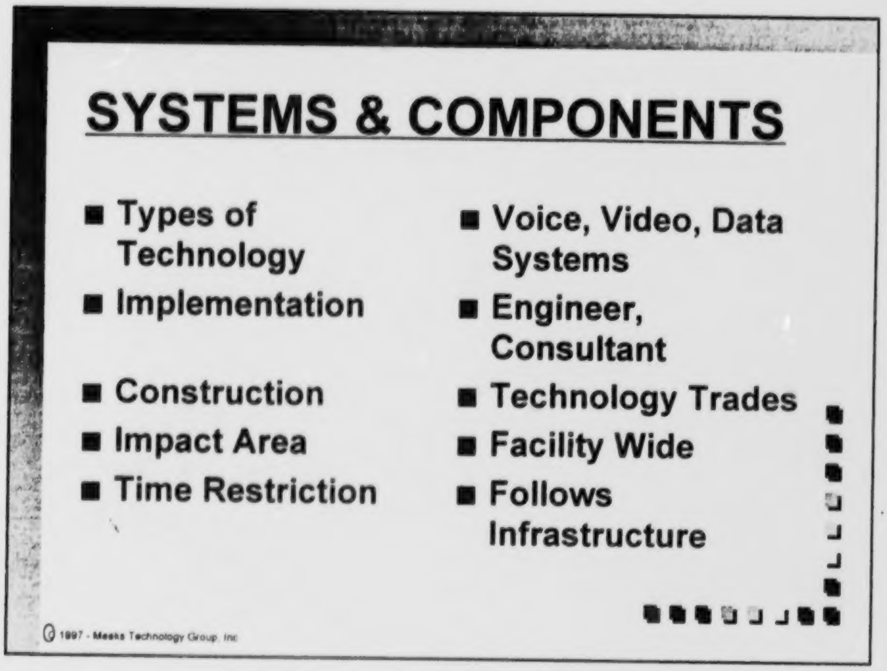
SPECIAL LABS

■ Types of Technology	■ Computer Lab, Science Lab
■ Implementation	■ District w/Electrician
■ Construction	■ Electrical
■ Impact Area	■ Local Area
■ Time Restriction	■ Infrastructure First



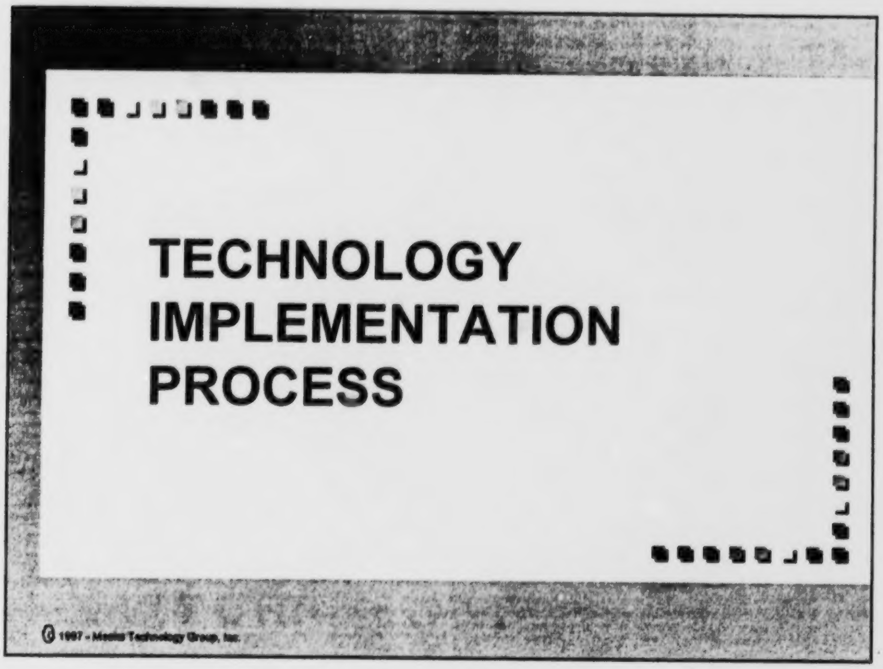
INFRASTRUCTURE

■ Types of Technology	■ AC Power, Cable Paths, HVAC
■ Implementation	■ Architect, Engineer Consultant
■ Construction	■ General Trades
■ Impact Area	■ Facility Wide
■ Time Restriction	■ Based on Construction Process

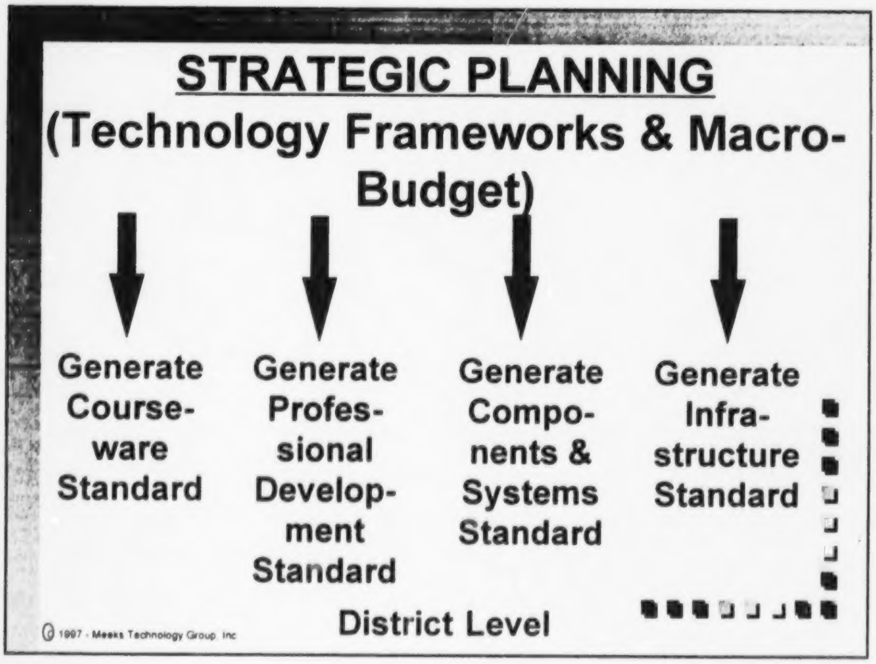


SYSTEMS & COMPONENTS

- Types of Technology
- Implementation
- Construction
- Impact Area
- Time Restriction
- Voice, Video, Data Systems
- Engineer, Consultant
- Technology Trades
- Facility Wide
- Follows Infrastructure



TECHNOLOGY IMPLEMENTATION PROCESS



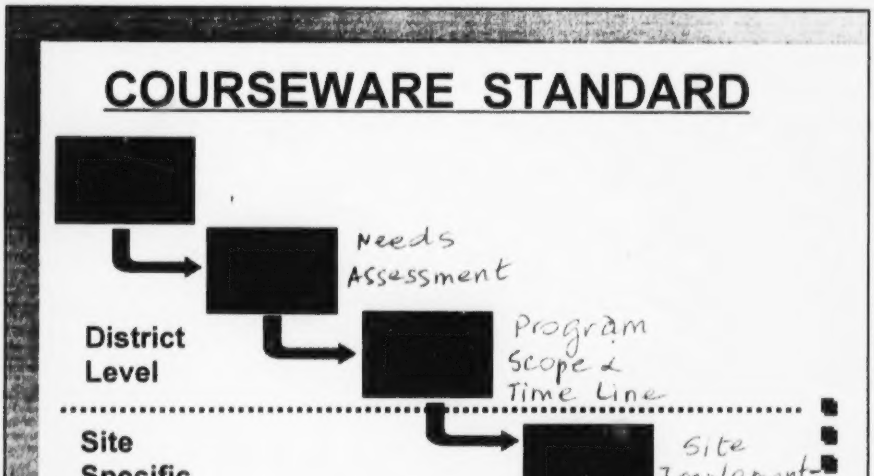
STRATEGIC PLANNING

(Technology Frameworks & Macro-Budget)

- Generate Courseware Standard
- Generate Professional Development Standard
- Generate Components & Systems Standard
- Generate Infrastructure Standard

District Level

Generate Courseware standard



COURSEWARE STANDARD

Needs Assessment

District Level

Program Scope & Time Line

Site Specific

Site Implementation

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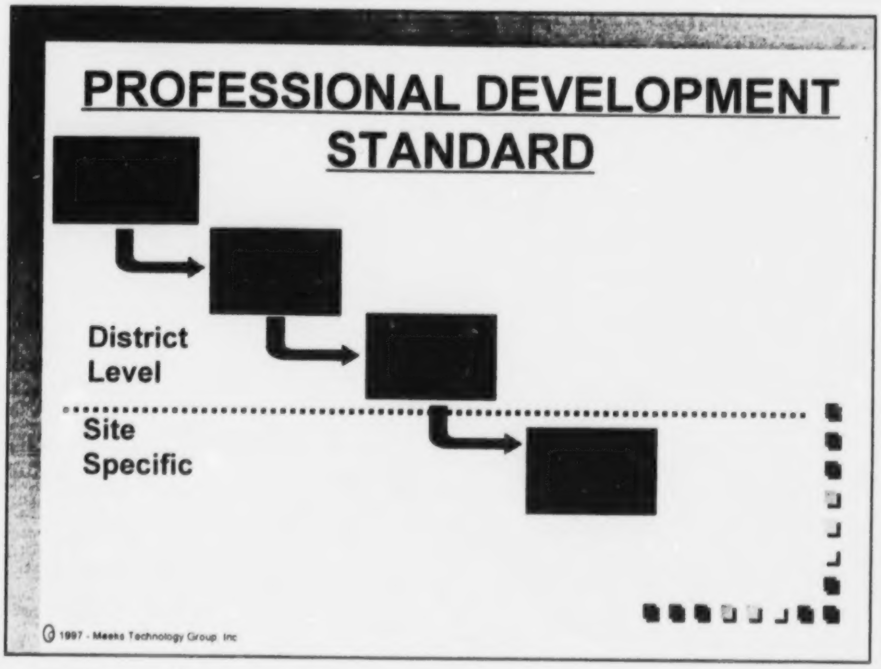

PROFESSIONAL DEVELOPMENT STANDARD

District Level

Site Specific

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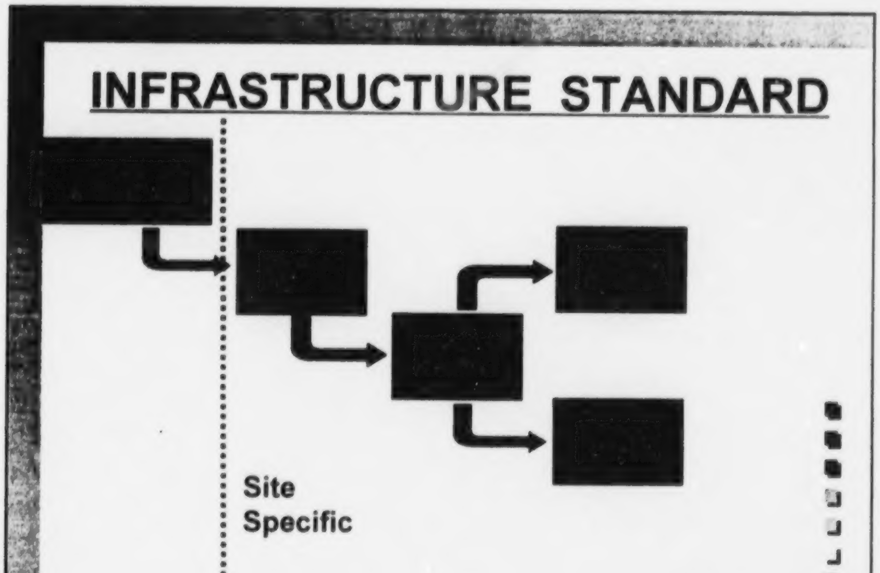

INFRASTRUCTURE STANDARD

Site Specific

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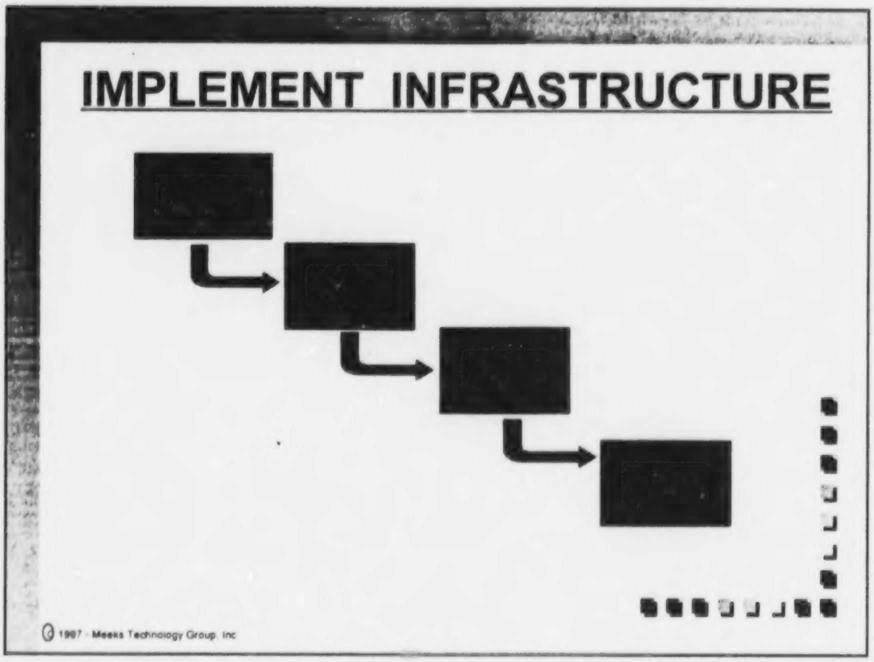
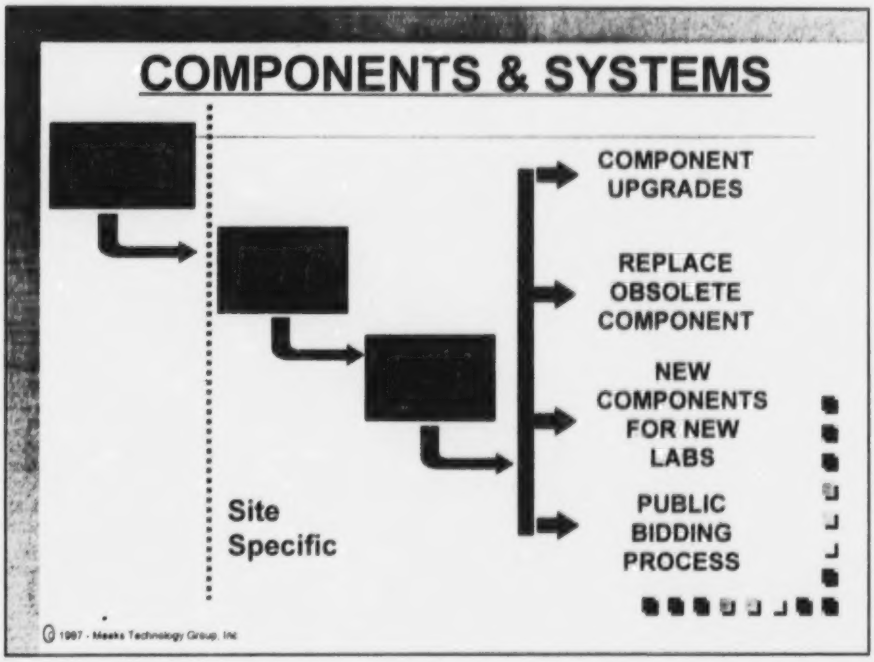


IMPLEMENT INFRASTRUCTURE



COMPONENTS & SYSTEMS

- COMPONENT UPGRADES
- REPLACE OBSOLETE COMPONENT
- NEW COMPONENTS FOR NEW LABS
- PUBLIC BIDDING PROCESS

Site Specific

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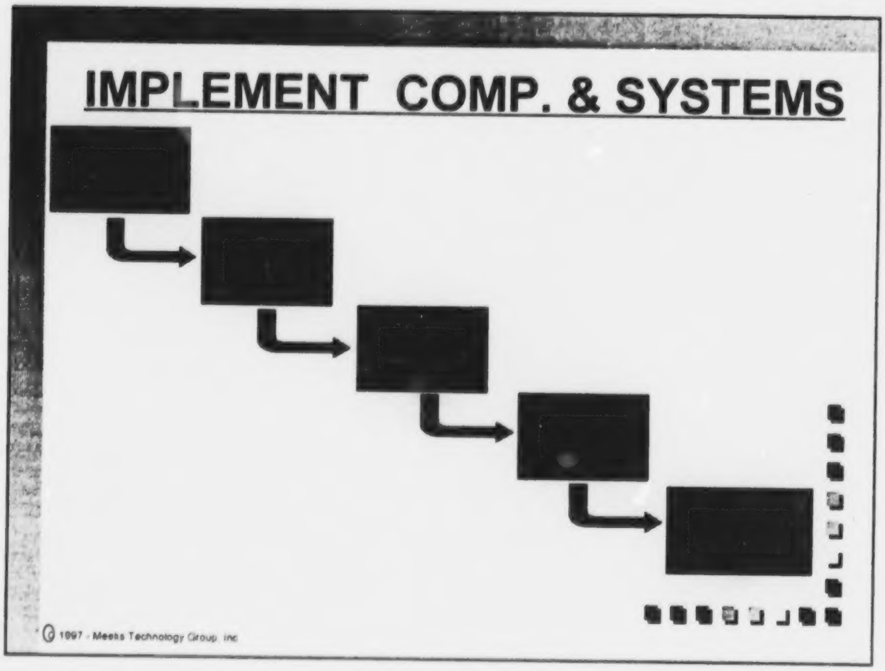
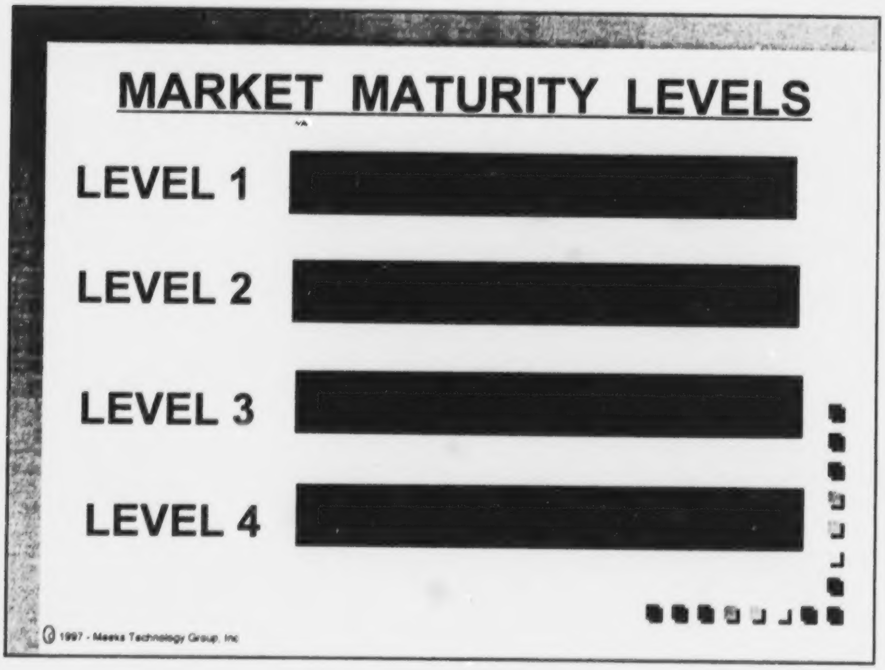


IMPLEMENT COMP. & SYSTEMS



MARKET MATURITY LEVELS

LEVEL 1

LEVEL 2

LEVEL 3

LEVEL 4

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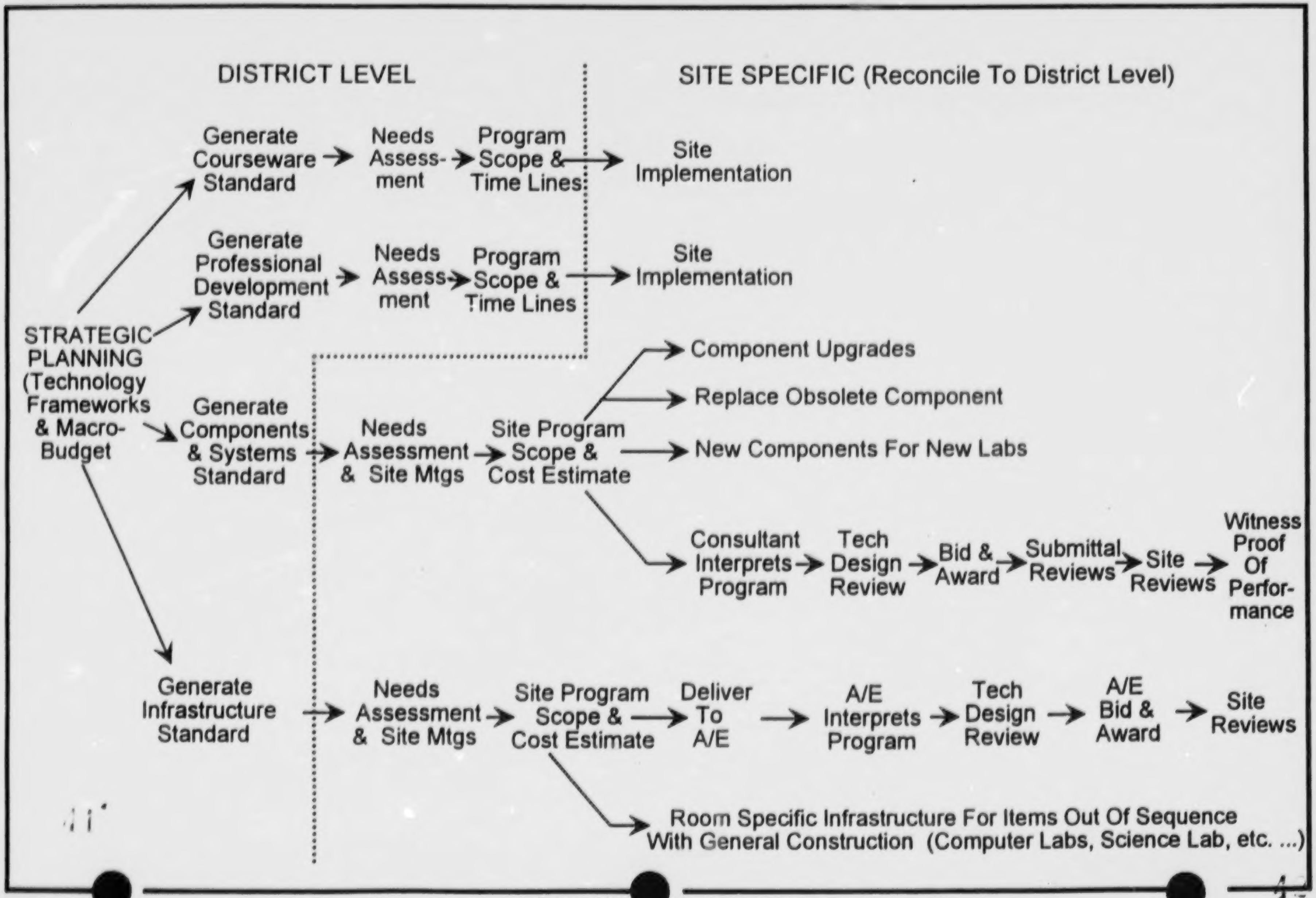
TECHNOLOGY IMPLEMENTATION PROCESS



DISTRICT LEVEL

SITE SPECIFIC (Reconcile To District Level)

STRATEGIC PLANNING (Technology Frameworks & Macro-Budget)

Generate Courseware Standard → Needs Assessment → Program Scope & Time Lines → Site Implementation

Generate Professional Development Standard → Needs Assessment → Program Scope & Time Lines → Site Implementation

Generate Components & Systems Standard → Needs Assessment & Site Mtgs → Site Program Scope & Cost Estimate

→ Component Upgrades

→ Replace Obsolete Component

→ New Components For New Labs

→ Consultant Interprets Program → Tech Design Review → Bid & Award → Submittal Reviews → Site Reviews → Witness Proof Of Performance

Generate Infrastructure Standard → Needs Assessment & Site Mtgs → Site Program Scope & Cost Estimate → Deliver To A/E → A/E Interprets Program → Tech Design Review → A/E Bid & Award → Site Reviews

→ Room Specific Infrastructure For Items Out Of Sequence With General Construction (Computer Labs, Science Lab, etc. ...)

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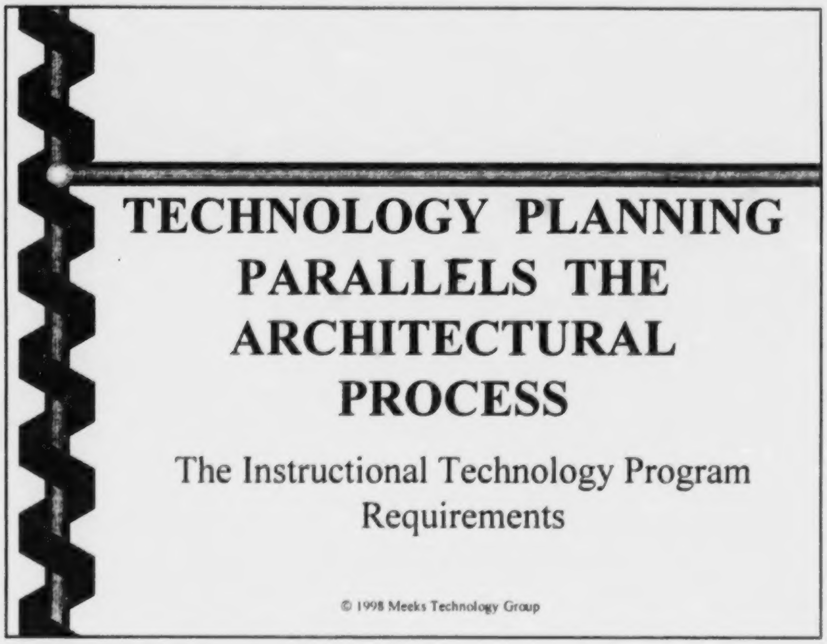
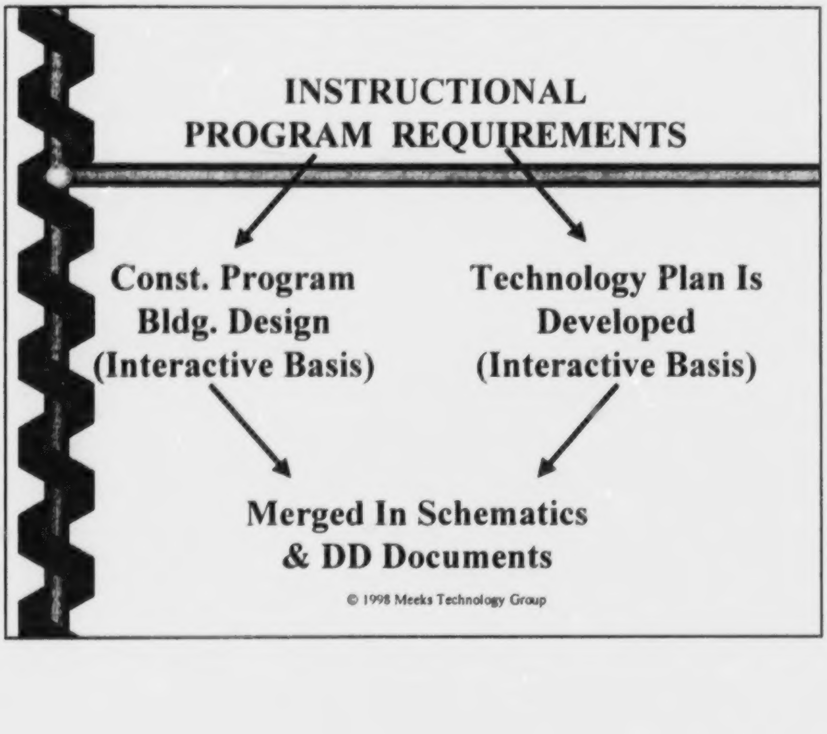
TECHNOLOGY IMPLEMENTATION CATEGORIES

CATEGORIES	TYPES OF TECHNOLOGY	IMPLEMENTATION	CONSTRUCTION	IMPACT AREA	TIME RESTRICTION
UPGRADE COMPONENTS	COMPUTER (RAM, Hard Drive, Network Card)	DIRECT BY DISTRICT	NONE	NONE	NONE
REPLACE OBSOLETE COMPONENTS	COMPUTERS PRINTERS VIDEO DISPLAYS A/V SOURCES	DIRECT BY DISTRICT	NONE	NONE	NONE
NEW COMPONENTS IN NEW AREA	COMPUTER LAB APPLIED TECH LAB SCIENCE LAB PRODUCTION CTR	DIRECT BY DISTRICT with ELECTRICIAN	ELECTRICAL	LOCAL INSTRUCTIONAL AREA	INFRASTRUCTURE OF LOCAL AREA MUST BE COMPLETED
NEW INFRASTRUCTURE	AC POWER CABLE PATH HVAC	DISTRICT AGENTS (Architect, Engineer, Consultant)	GENERAL TRADES	FACILITY WIDE	COMPLETION IS BASED ON CONSTRUCTION PROCESS
NEW SYSTEMS & NEW COMPONENTS	VOICE SYSTEMS DATA SYSTEMS VIDEO SYSTEMS	DISTRICT AGENT (Engineer, Consultant)	TECHNOLOGY TRADES	FACILITY WIDE	COMPLETION IS BASED ON COMPLETION OF INFRASTRUCTURE



TECHNOLOGY PLANNING PARALLELS THE ARCHITECTURAL PROCESS

The Instructional Technology Program Requirements

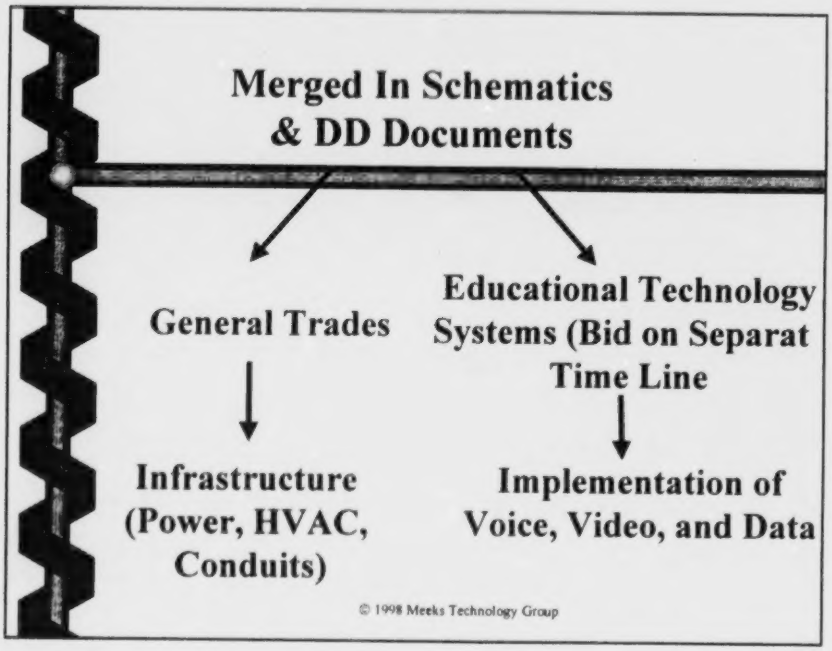


INSTRUCTIONAL PROGRAM REQUIREMENTS

Const. Program Bldg. Design (Interactive Basis)

Technology Plan Is Developed (Interactive Basis)

Merged In Schematics & DD Documents



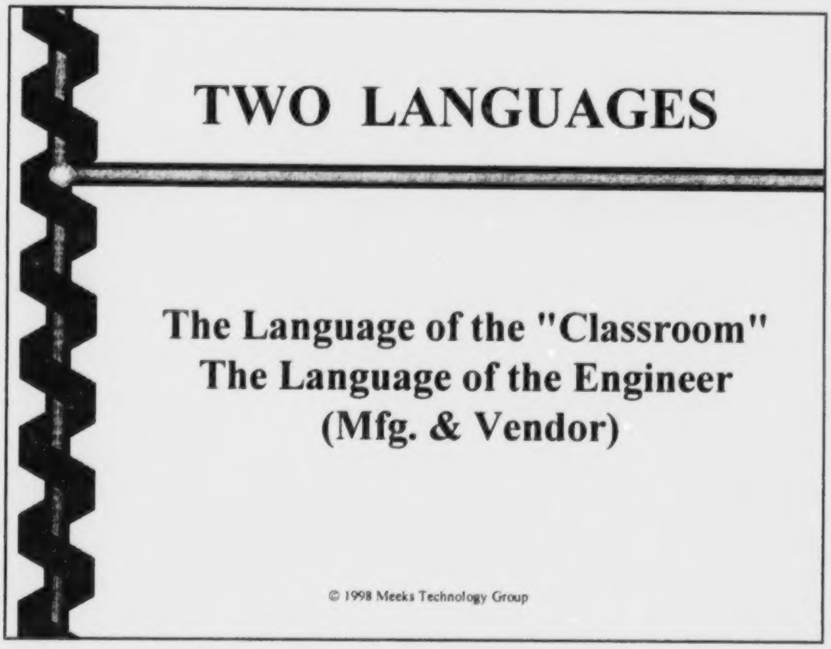
Merged In Schematics & DD Documents

General Trades

Infrastructure (Power, HVAC, Conduits)

Educational Technology Systems (Bid on Separat Time Line

Implementation of Voice, Video, and Data



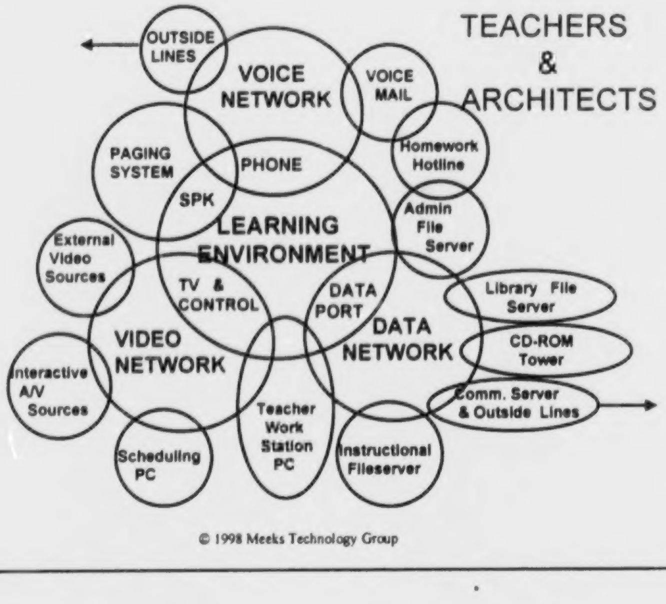
TWO LANGUAGES

The Language of the "Classroom"
The Language of the Engineer
(Mfg. & Vendor)

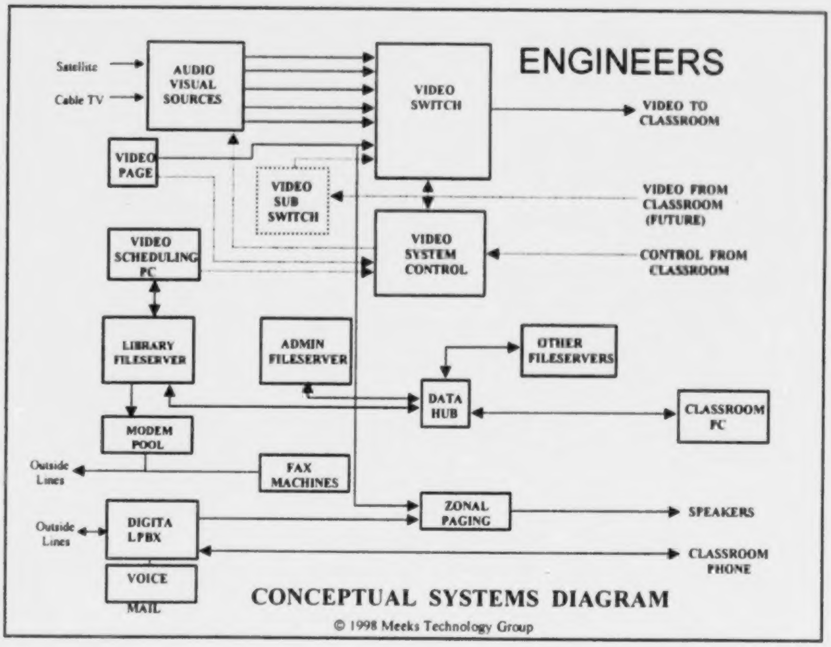
- Arch./Planner Understands the "Business" of the Classroom.
- Uses an Interactive Process to Determine Needs
- Direct Translation of User Needs
- Owner Buy In Occurs

- Engineer Does Not Understand the "Business of the Classroom.
- Calculates an Outcome (Does Not Use An Interactive/ People Process).
- Subject to Misunder-Standing.
- No Buy-In

TEACHERS
&
ARCHITECTS



ENGINEERS



CONCEPTUAL SYSTEMS DIAGRAM

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TECHNOLOGY MASTER PLANS

Building The Roadmap

Technology Changes the Business of the Classroom

The Majority of Teachers Have NOT Received Training Regarding How TO Use Instructional Technology In The Classroom (Presentation or Project Based)

IMPEDIMENTS TO CHANGE

- TIME
- SPACE
- MONEY
- ATTITUDES
- APPLICABLE TECHNOLOGY

The Primary Method to Assist People Embrace Change

Create a Sense of Ownership

OWNERSHIP

The Users Of Technology
(or their representatives)
Must Have Input Regarding The Issues Impacting Their Business
(instruction in the classroom)

PLANNING PARTICIPANTS

COMMUNITY
(Parents, Business)

STAFF (Technological and Non-Technological)

Students

Board

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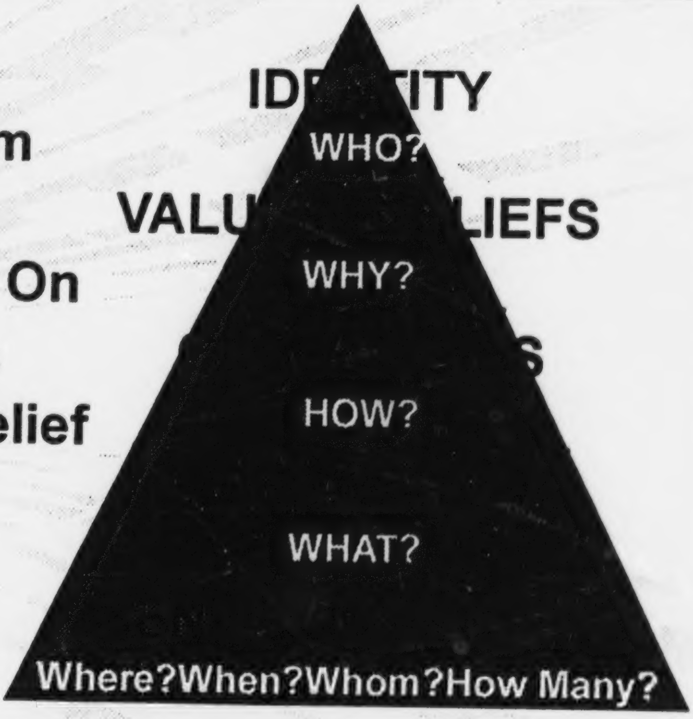
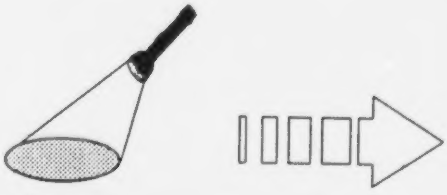
Effective Long Term Planning Focuses On Identity & Values/Belief



PROCESS (Continued)



WHY PHONE?

WHY COMPUTER?

WHY VIDEO?

WHO ARE YOUR CLIENTS?

WHAT SKILLS/KNOW. DO THEY NEED?

HOW TO USE TECH.?

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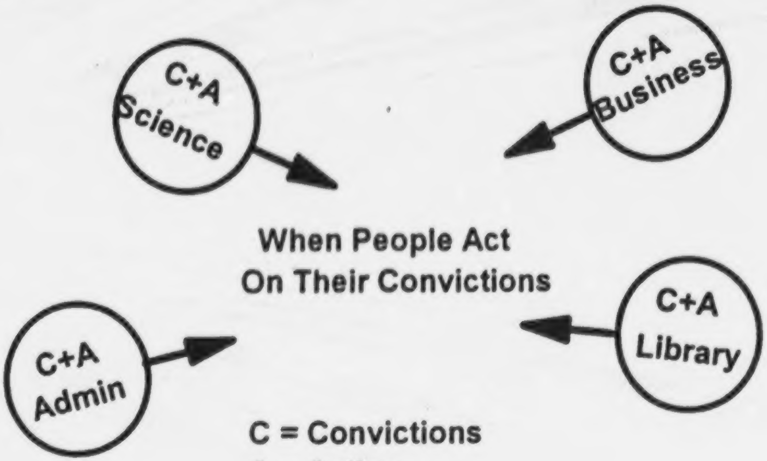
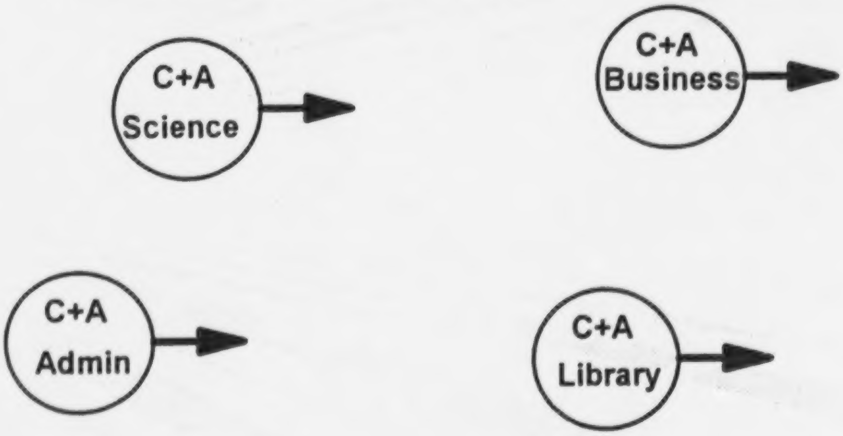
WHEN A VISION DOES NOT EXIST



When People Act
On Their Convictions

C = Convictions
A = Actions

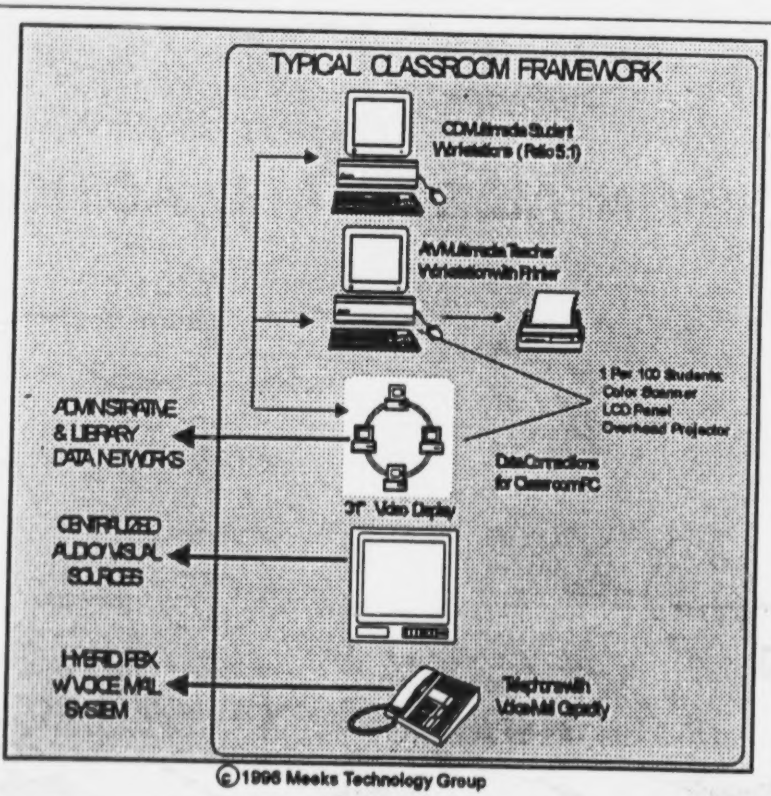
VISION ALIGNS ALL ACTIONS



PROCESS (Continued)

DISTRICT ISSUES
(The Hindrances and Roadblocks, Political and Personnel.)

TECHNOLOGY FRAMEWORKS
(Technology Ed Specs of Every Space In Every Facility.)


TYPICAL CLASSROOM FRAMEWORK
CD/Multimedia Student Workstations (Ratio 5:1)
AV/Multimedia Teacher Workstation with Printer
1 Per 100 Students: Color Scanner LCD Panel Overhead Projector
ADMINISTRATIVE & LIBRARY DATA NETWORKS
Data Connections for Classroom PC
31" Video Display
CENTRALIZED AUDIO/VISUAL SOURCES
HYBRID PBX W/VOICE MAIL SYSTEM
Telephone with Voice Mail Capacity

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PROCESS (Continued)

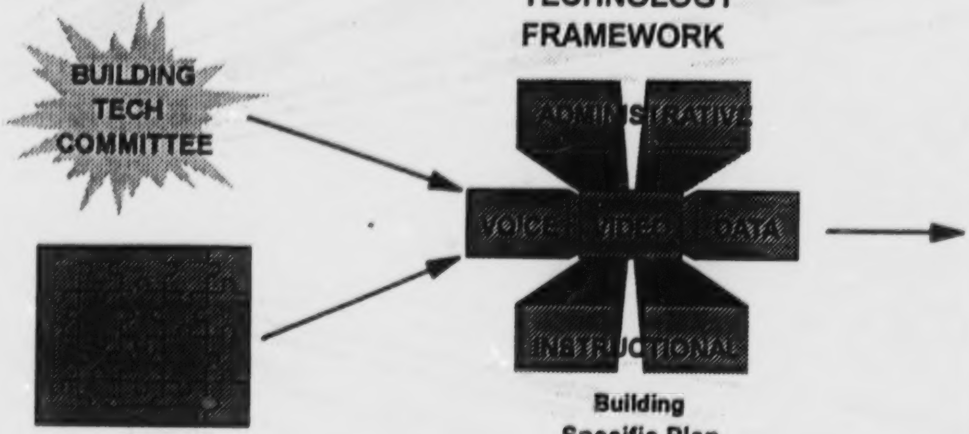
IDEAL COST ESTIMATE
(Long Term Funding Requirements)

DISTRICT GOAL
(Real Funds Available Placed Into A Timeline.)

Process Takes Two 2 Day Planning Labs and a Total of 90 Days From Initializatoin To Completion.

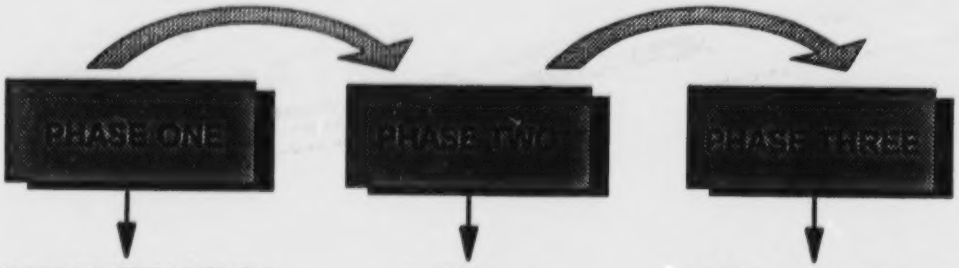
BUILDING SPECIFIC TECHNOLOGY PLAN

TECHNOLOGY
FRAMEWORK



Building
Specific Plan

DISTRICT
WIDE PLAN



INFRASTRUCTURE	SYSTEMS	LOOSE EQUIPMENT
ARCH / ENGR CONSULTANT	ARCH / ENGR CONSULTANT	OWNER CONSULTANT
GENERAL TRADES ELECTRICAL WORK	SPECIAL TRADES AS PART OF GENERAL CONST. (10-6 Months Prior)	DIRECT TO OWNER (4 Months Prior To First Use)

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INFRASTRUCTURE
(Thirty or Forty Year Issues/Money)

- Locate All Potential Technology Points in Building
- Provide AC Power As Required
- Provide Cable Access As Required
- Meet HVAC Needs

TECHNOLOGY SYSTEMS
(Ten Year Issues/Money)

- Provide Bid Documents For System Which Support Goals (Voice, Video, and Data Systems)
- Provide Cabling With Systems
- Provide Training With Systems

LOOSE EQUIPMENT
(Three Year Issues/Money)

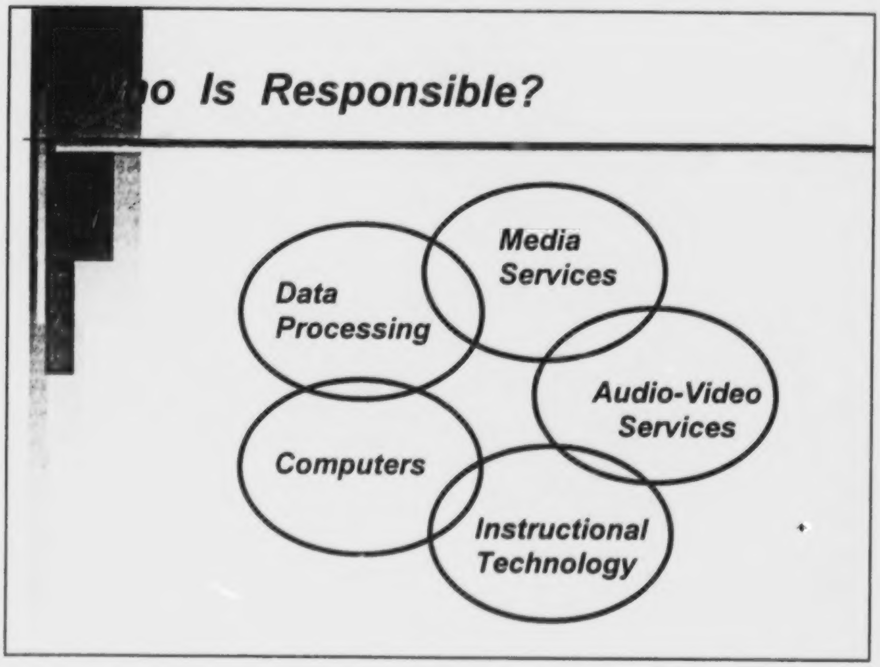
- Computers and Printers
- Courseware
- Library Systems
- Applied Technology Systems
- Special Applications

SUPPORT STAFF ORGANIZATION

EDUCATIONAL TECHNOLOGY SYSTEMS & SUPPORT

Technology Causes Overlap and Blurring of Traditional Support Categories

Duplicate Purchases - Incompatibility Issues



o Is Responsible?

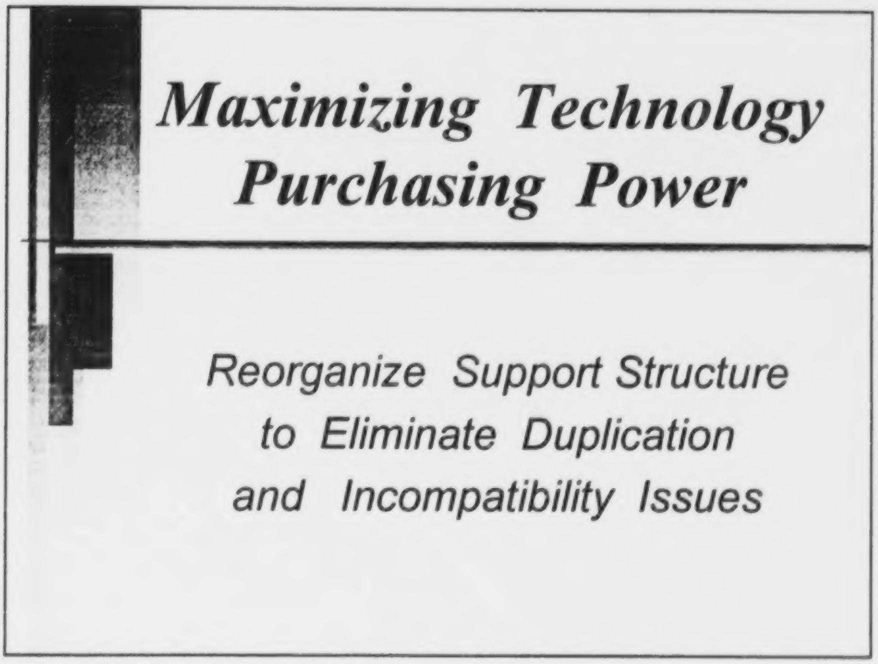
Data Processing

Media Services

Audio-Video Services

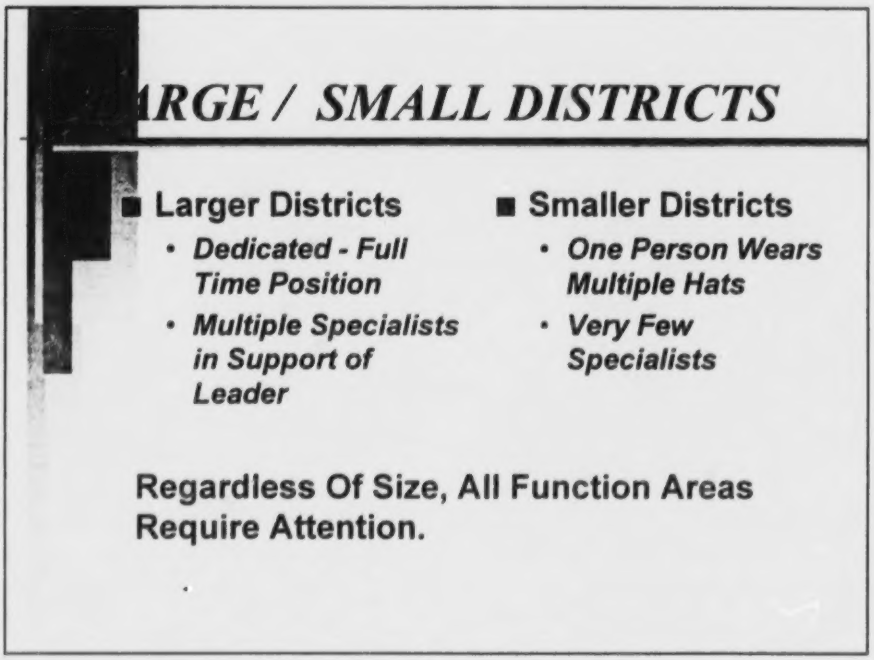
Computers

Instructional Technology



Maximizing Technology Purchasing Power

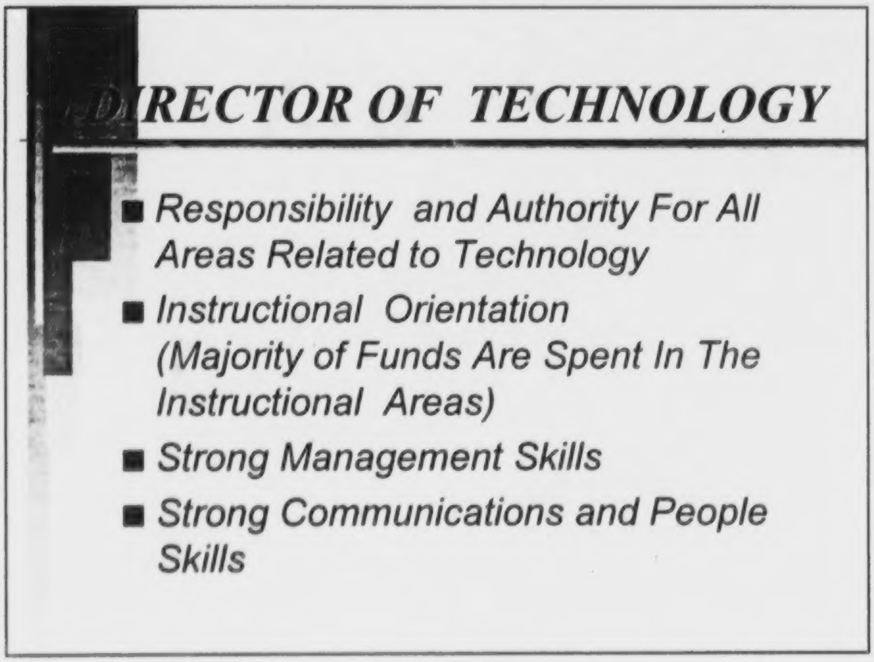
Reorganize Support Structure
to Eliminate Duplication
and Incompatibility Issues



ARGE / SMALL DISTRICTS

- Larger Districts
  - *Dedicated - Full Time Position*
  - *Multiple Specialists in Support of Leader*
- Smaller Districts
  - *One Person Wears Multiple Hats*
  - *Very Few Specialists*

Regardless Of Size, All Function Areas Require Attention.



DIRECTOR OF TECHNOLOGY

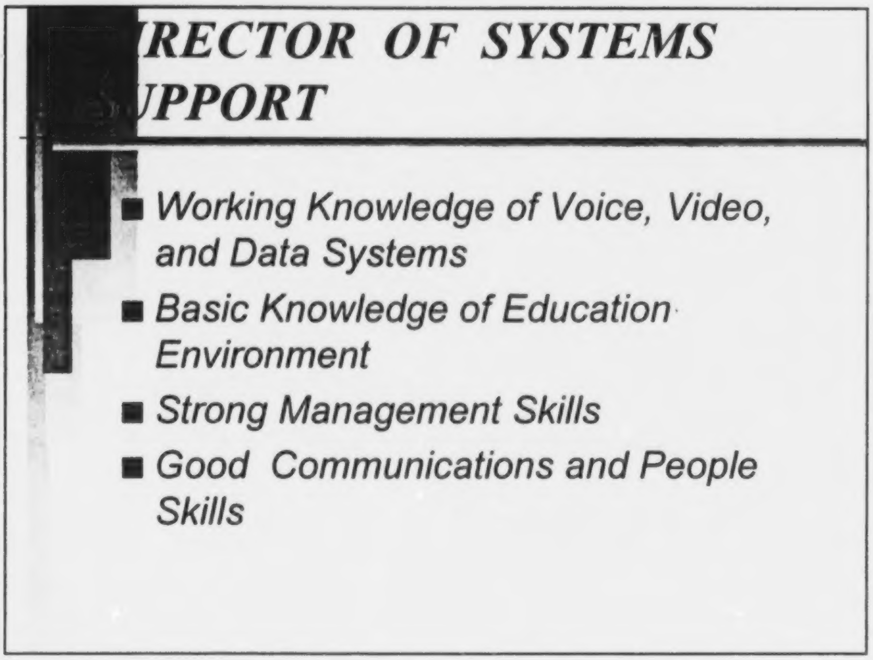
- *Responsibility and Authority For All Areas Related to Technology*
- *Instructional Orientation (Majority of Funds Are Spent In The Instructional Areas)*
- *Strong Management Skills*
- *Strong Communications and People Skills*

RESPONSIBILITIES

- Articulate and Maintain Vision For Technology
- Oversee Tech. Systems and Support
- Yearly Technology Budget Requests
- Coordinate Tech. Support With Other Areas Within District
- Oversee Hardware and Software Purchases
- Facilitate Policy Definitions

REMAINING STAFF OVERVIEW (2 CAMPS)

- Things People
  - **Voice, Video, and Data Components & Networks**
  - **Computers**
  - **Cabling**
  - **Repair**
- People People
  - **Staff Development**
  - **Matching Curriculum and Content**
  - **Assessment and Evaluation**



IRECTOR OF SYSTEMS UPPORT

- Working Knowledge of Voice, Video, and Data Systems
- Basic Knowledge of Education Environment
- Strong Management Skills
- Good Communications and People Skills

RESPONSIBILITIES

- Review Hardware and OS Software Purchases for Compatibility Issues
- Data Network Systems
  - **Computer Repair and Maintenance**
- Voice Systems
- Audio-Visual Systems
  - **Phone & A/V Repair and Maintenance**
- Co-Management of Help Desk

SPECIALIST

- Maintains Administrative Computing Servers and Software
  - **Data Processing (Financials)**
  - **Student Services**
  - **Transportation**
- Answers to Business Manager and Director of Technology Systems

NETWORK ADMINISTRATOR

- Maintains Instructional Servers and Related Software & Distribution
- Maintains Building Level LANs
  - **Network Software (Directory Trees and IP Addressing - Internet Access)**
  - **Hubs, Switches, Router**
  - **Workstations Operating on LAN**
- Maintains WAN
- Review Hardware Purchases

OMPUTER REPAIR/MAINT.

- Operates in Support of Network Administrators
- Responsible for Repair and Maintenance of All Computers, Monitors, Printers, and Related Peripherals

OICE SYSTEMS

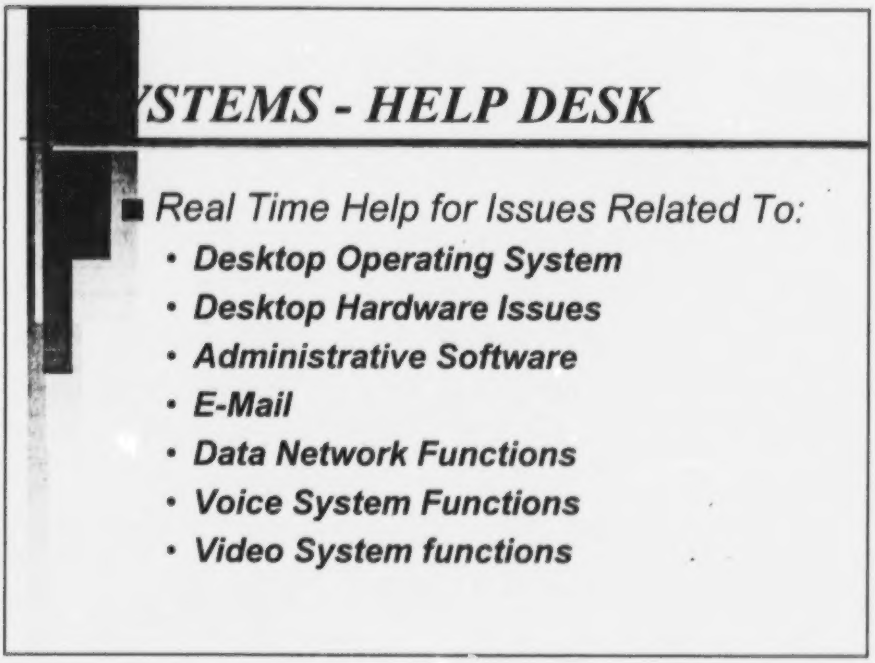
- Management of All Voice Systems
  - **Phone Systems**
  - **Voice-Mail Systems**
  - **Intercom / Paging Systems**
- Maintenance and Repair of Primary Systems
- Software Updates, Changes, Moves

DEO SYSTEMS

- Management of Video Systems
  - ***Video Distribution Systems***
  - ***Media Retrieval***
  - ***Distance Learning Systems***
  - ***Video Production Systems***
- Management of A/V Components
  - ***Displays - TVs, Projectors, etc..***
  - ***A/V Sources - VCR, LD, DVD***

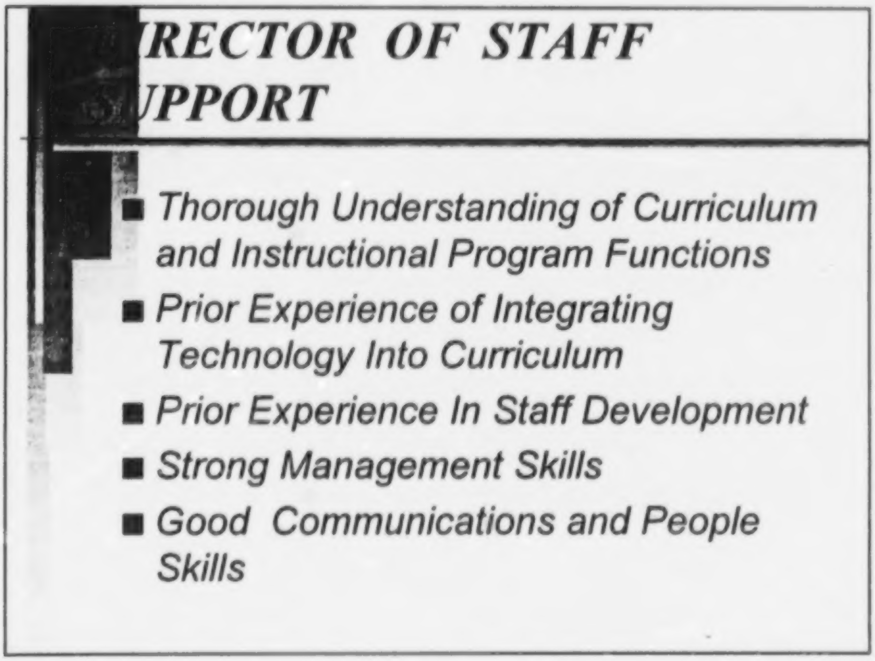
A/V REPAIR & MAINTENANCE

- Operates in Support of Voice and Video Systems Personnel
- Repair and Maintenance for:
  - ***Phone System and Components***
  - ***Intercom Systems***
  - ***Video Systems***
  - ***Displays***
  - ***A/V Sources***



YSTEMS - HELP DESK

- Real Time Help for Issues Related To:
  - **Desktop Operating System**
  - **Desktop Hardware Issues**
  - **Administrative Software**
  - **E-Mail**
  - **Data Network Functions**
  - **Voice System Functions**
  - **Video System functions**



IRECTOR OF STAFF UPPORT

- *Thorough Understanding of Curriculum and Instructional Program Functions*
- *Prior Experience of Integrating Technology Into Curriculum*
- *Prior Experience In Staff Development*
- *Strong Management Skills*
- *Good Communications and People Skills*

ESPONSIBILITIES

- Review Courseware Purchases Matched to Curriculum/Instruction
- Manage Media Center and Services
  - **Building Level Media Centers Services**
- Manage Staff Development
  - ***District Level***
  - ***Building Level***
- Co-Management of Help Desk

ISTRICT MEDIA CENTER

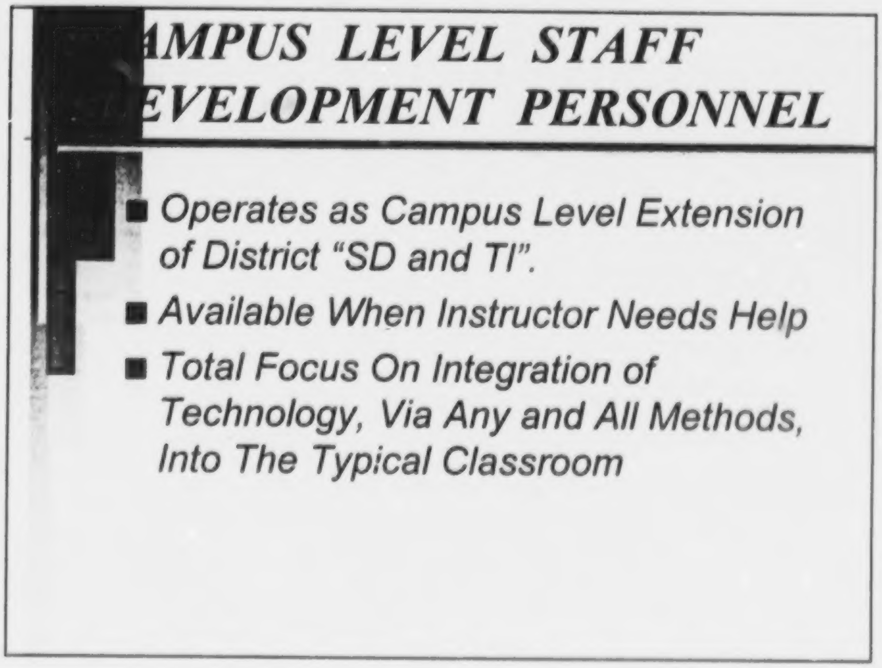
- Setting Standards For All Media Centers
- Integration of Technology Into Media Centers and Related Services
  - ***Library Automation Systems***
  - ***References - CD-ROM Tower, Etc...***
  - ***Production Systems***

AMPUS MEDIA CENTERS

- Operates in Support of Information Delivery to Instructional Program
- Management of Campus Media Centers
  - **Maintaining Records**
  - **Assist Users of Automation System**
  - **Operation of Productions Centers?**
  - **Maintain Reference Materials Which Are Not Paper Based**
  - **Copyright Policy**

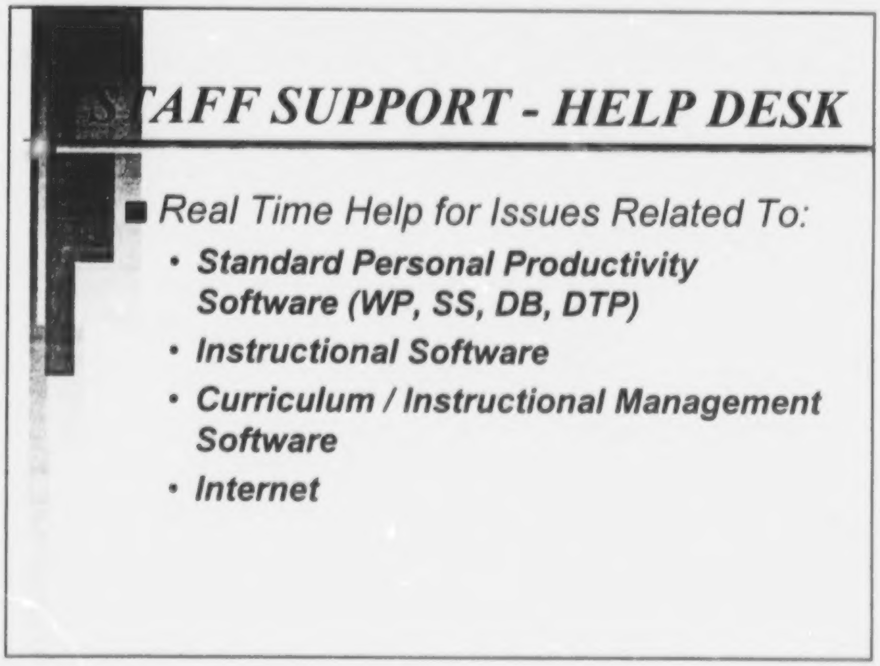
AFF DEVELOPMENT and
ECHNOLOGY INTEGRATION

- Areas of Training
  - **Basic Technology Trouble Shooting**
  - **Standard Productivity Software (WP,DB,SS)**
  - **Internet Access and Use**
  - **Instructional Applications**
  - **Curriculum / Instructional Management**
  - **Assessment and Evaluation**



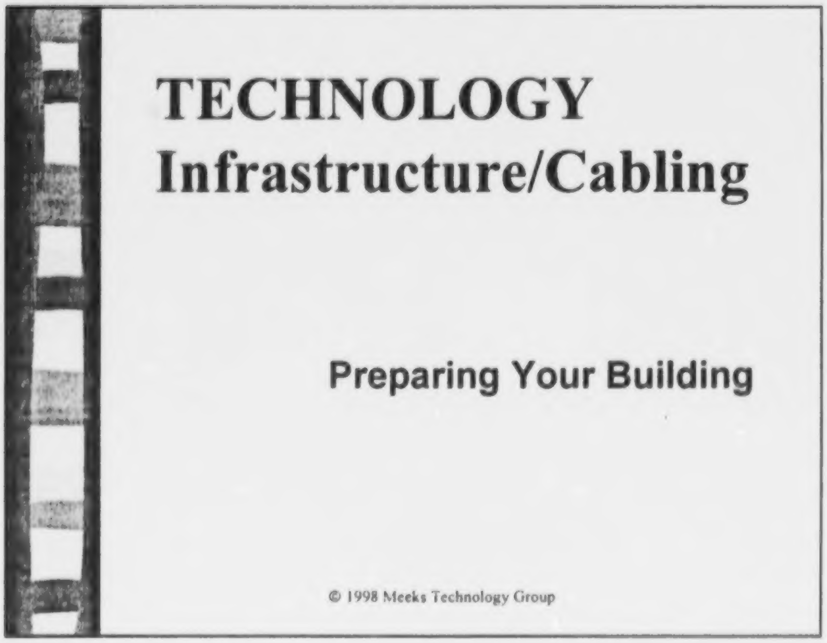
AMPUS LEVEL STAFF EVELOPMENT PERSONNEL

- Operates as Campus Level Extension of District "SD and TI".
- Available When Instructor Needs Help
- Total Focus On Integration of Technology, Via Any and All Methods, Into The Typical Classroom



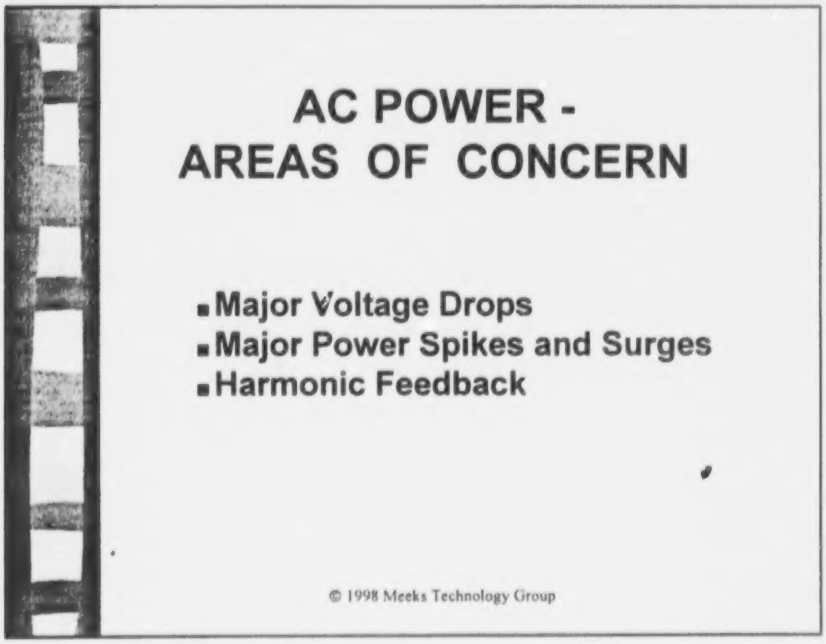
STAFF SUPPORT - HELP DESK

- Real Time Help for Issues Related To:
  - **Standard Personal Productivity Software (WP, SS, DB, DTP)**
  - **Instructional Software**
  - **Curriculum / Instructional Management Software**
  - **Internet**



TECHNOLOGY
Infrastructure/Cabling

Preparing Your Building



AC POWER - AREAS OF CONCERN

- Major Voltage Drops
- Major Power Spikes and Surges
- Harmonic Feedback

VOLTAGE DROPS & SURGES

- Voltage drops will cause computer to act like it has been turned off and back on.
  - Separate computer power from HVAC systems.
  - Install constant voltage transformer (expensive).
- Voltage spikes can damage power supply or components of the computer.
  - Use MOV (Metal Oxide Varistor) surge protectors.

HARMONIC FEEDBACK

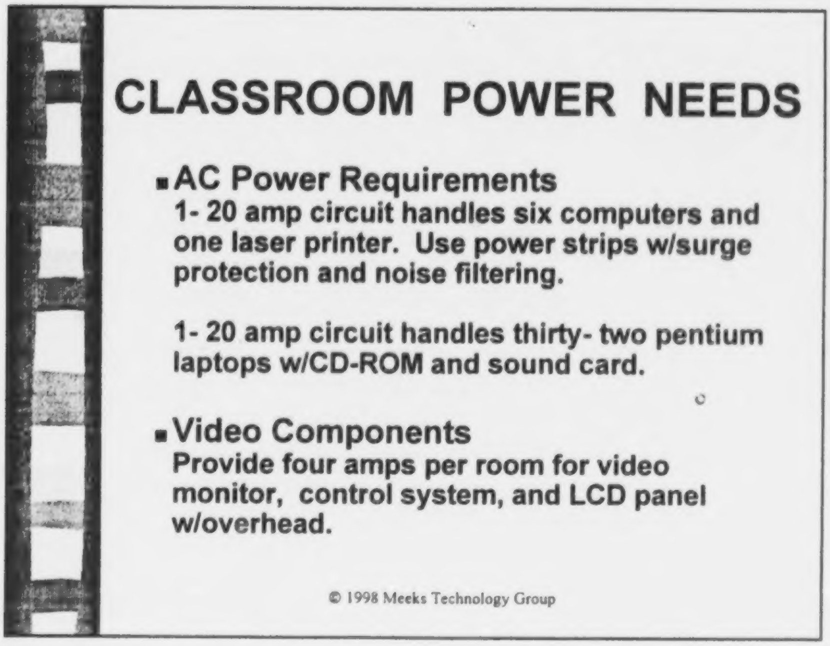
- Computer Power Supplies Generate Harmonic Feedback on Neutral Circuit.
  - One neutral conductor for every hot conductor or oversize neutral by 200%.
  - Electrical panel to transformer neutral must be oversized.
  - Provide transformers with correct "K" rating, minimum K-4. K rating means a larger secondary winding.

TECHNOLOGY POWER IN THE CLASSROOM

- **Therefore, Items Which Are No Longer A Concern.**
    - Isolated ground outlets (special outlets).
    - Isolated ground circuits and transformers.
    - Separation of convenience power (general use power) and technology power within the classroom.

TYPICAL POWER NEEDS

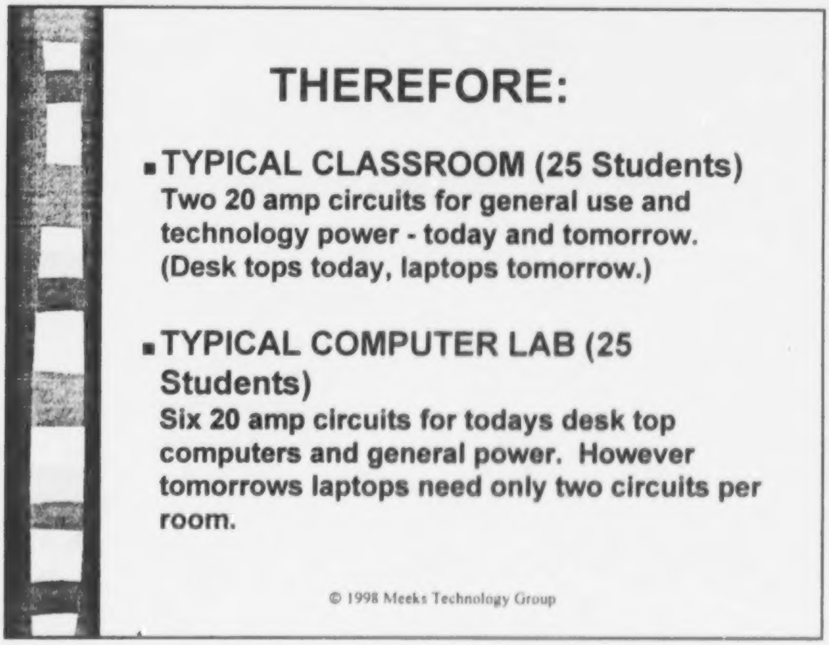
- Pentium Comp.- 1.25A
- 15"-17" Monitor - 1 A
- 21" Monitor - 1.5A
- Pentium Portable with CD-ROM- .5A
- Ink Jet Printer - .25A
- 5ppm Laser - 1.5A
- 12ppm Laser - 2.5A
- 31" TV - 3A
- Data Projector - 6A
- HP III Laser - 7.6A
- Apple IIE - 4.5A



CLASSROOM POWER NEEDS

- AC Power Requirements
  1- 20 amp circuit handles six computers and one laser printer. Use power strips w/surge protection and noise filtering.

  1- 20 amp circuit handles thirty- two pentium laptops w/CD-ROM and sound card.
- Video Components
  Provide four amps per room for video monitor, control system, and LCD panel w/overhead.



THEREFORE:

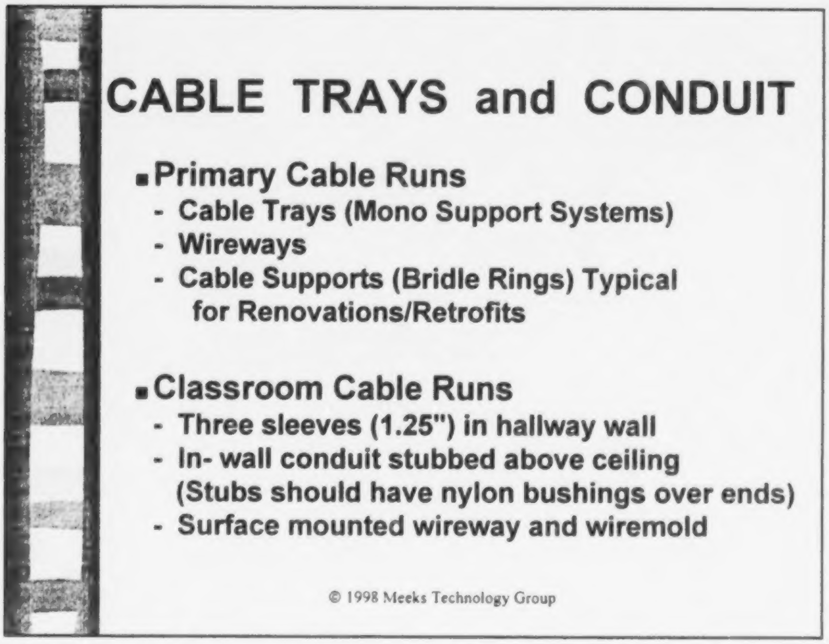
- TYPICAL CLASSROOM (25 Students)
  Two 20 amp circuits for general use and technology power - today and tomorrow. (Desk tops today, laptops tomorrow.)
- TYPICAL COMPUTER LAB (25 Students)
  Six 20 amp circuits for todays desk top computers and general power. However tomorrows laptops need only two circuits per room.

HEADEND POWER NEEDS

- **Fileservers and Network Components**
  Provide 4 amps per fileserver, 1 amp per network component. All components are served by a UPS.
- **Video Information System**
  2 - 20 amp circuits for first two racks and one 20 amp circuit for every two racks thereafter.
- **Telephone**
  1 - 20 amp circuit. Provide surge protection for all trunks (telephone & data) entering building.

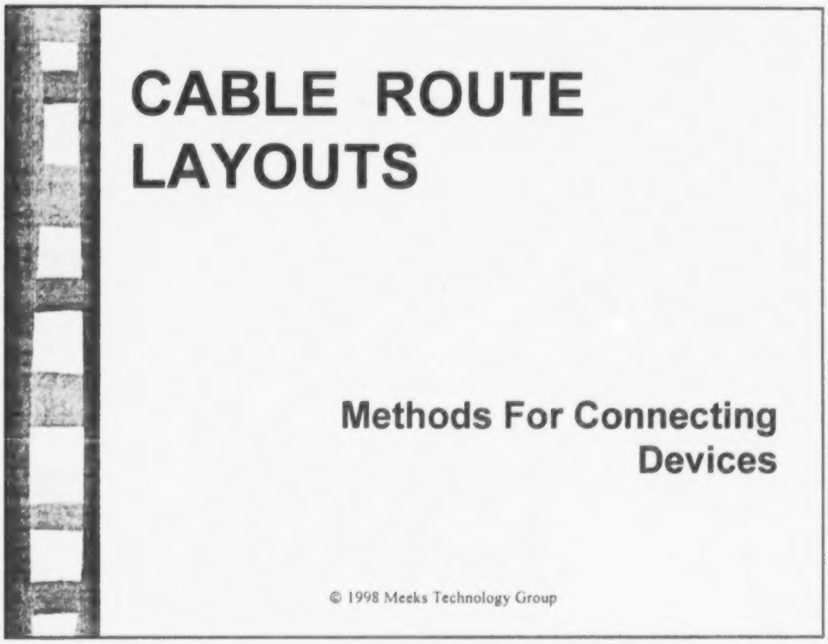
HVAC REQUIREMENTS

- **Classroom**
  5 computers raise HVAC cooling needs by 25%. 20 computers will double HVAC cooling needs.
- **Headend**
  All headend rooms are cooled "YEAR ROUND". Small systems require 5,000 btu cooling capacity. Large headends require 12,000 btu capacity.



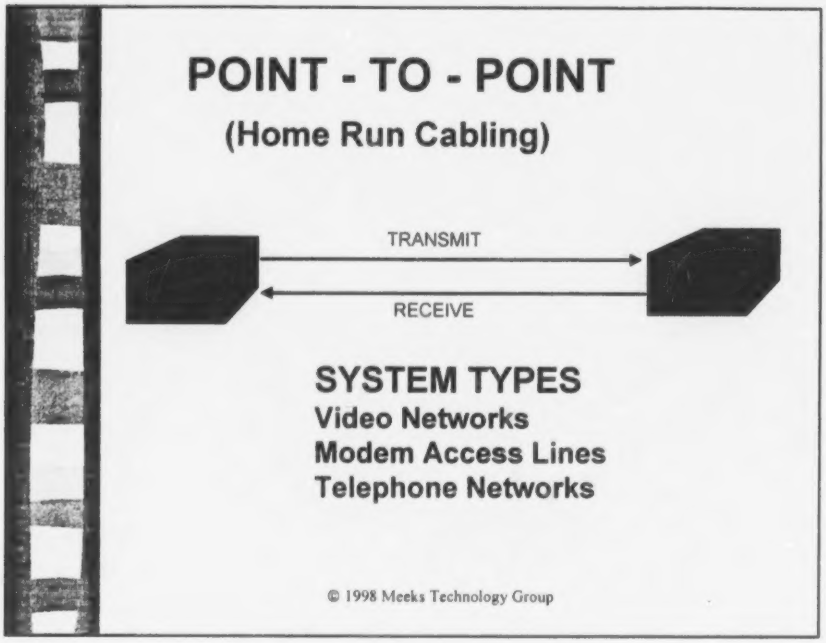
CABLE TRAYS and CONDUIT

- Primary Cable Runns
  - Cable Trays (Mono Support Systems)
  - Wireways
  - Cable Supports (Bridle Rings) Typical for Renovations/Retrofits
- Classroom Cable Runns
  - Three sleeves (1.25") in hallway wall
  - In- wall conduit stubbed above ceiling (Stubs should have nylon bushings over ends)
  - Surface mounted wireway and wiremold



CABLE ROUTE LAYOUTS

Methods For Connecting Devices



POINT - TO - POINT

(Home Run Cabling)

TRANSMIT

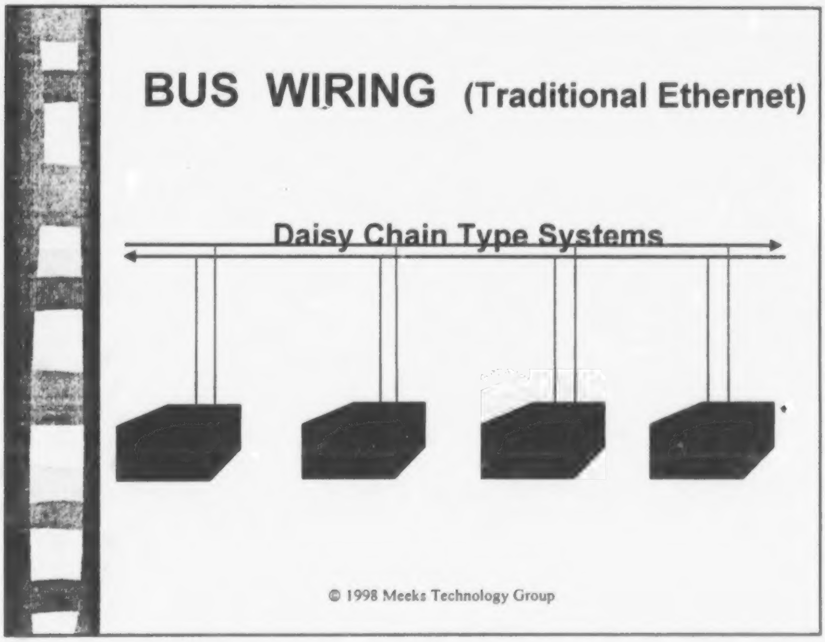
RECEIVE

SYSTEM TYPES

Video Networks

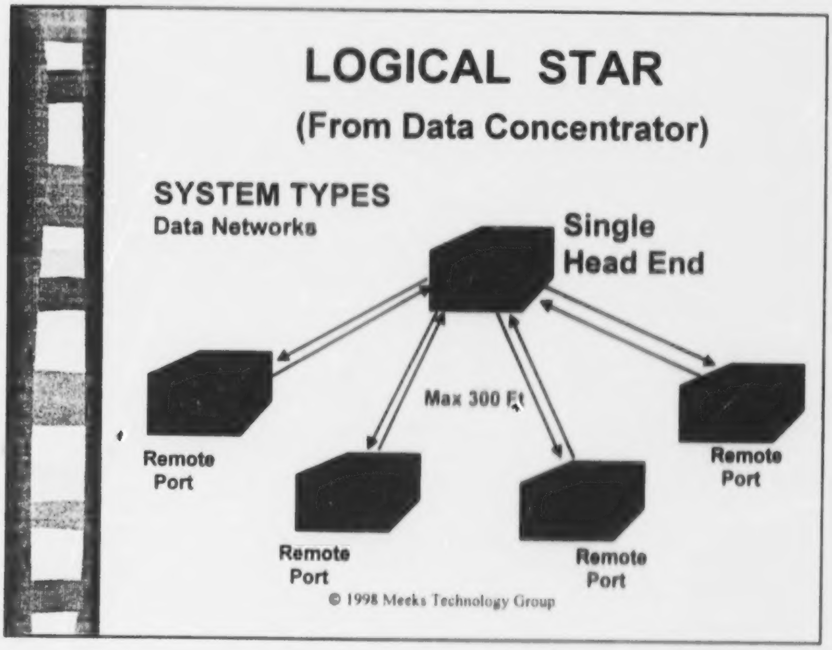
Modem Access Lines

Telephone Networks



BUS WIRING (Traditional Ethernet)

Daisy Chain Type Systems



LOGICAL STAR

(From Data Concentrator)

SYSTEM TYPES

Data Networks

Single Head End

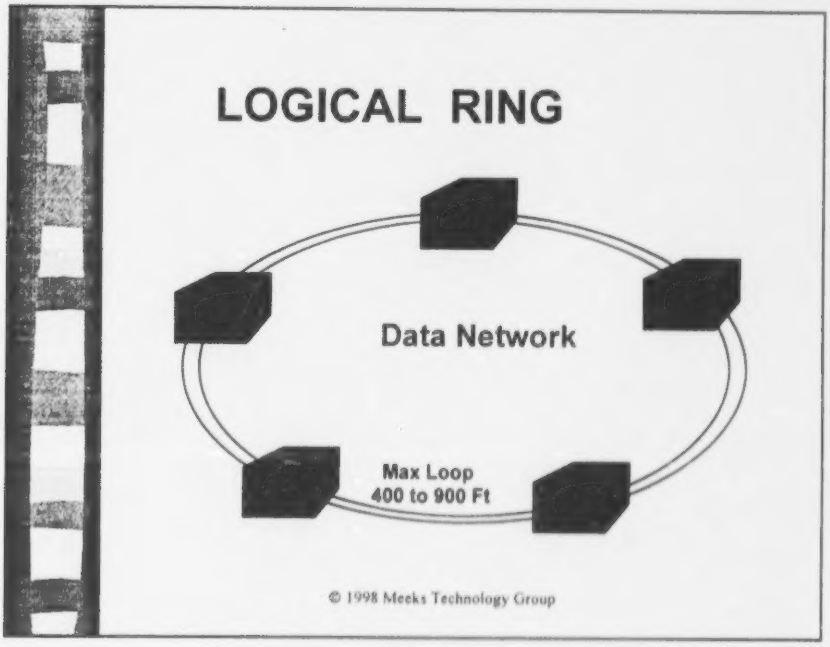
Max 300 Ft

Remote Port

Remote Port

Remote Port

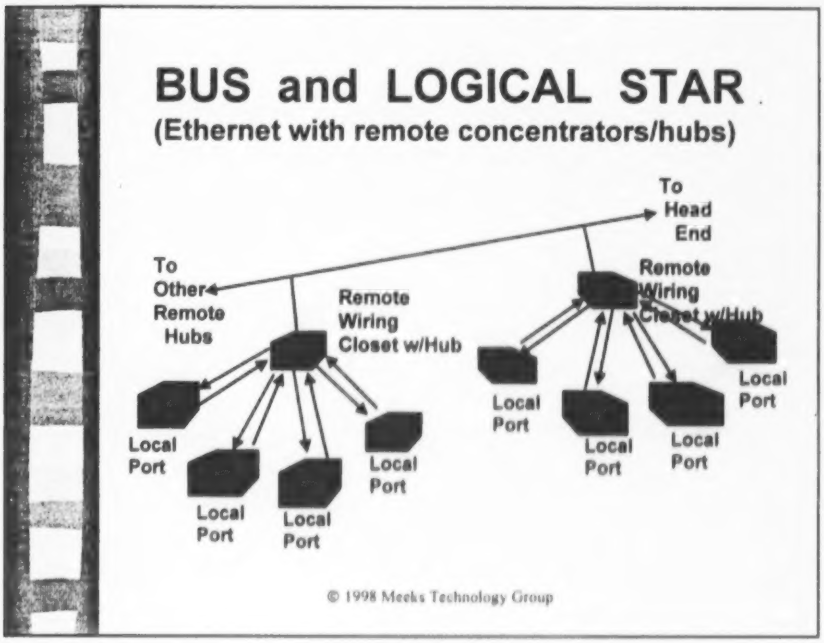
Remote Port



LOGICAL RING

Data Network

Max Loop 400 to 900 Ft



BUS and LOGICAL STAR

(Ethernet with remote concentrators/hubs)

To Other Remote Hubs

Remote Wiring Closet w/Hub

Local Port

Local Port

Local Port

Local Port

To Head End

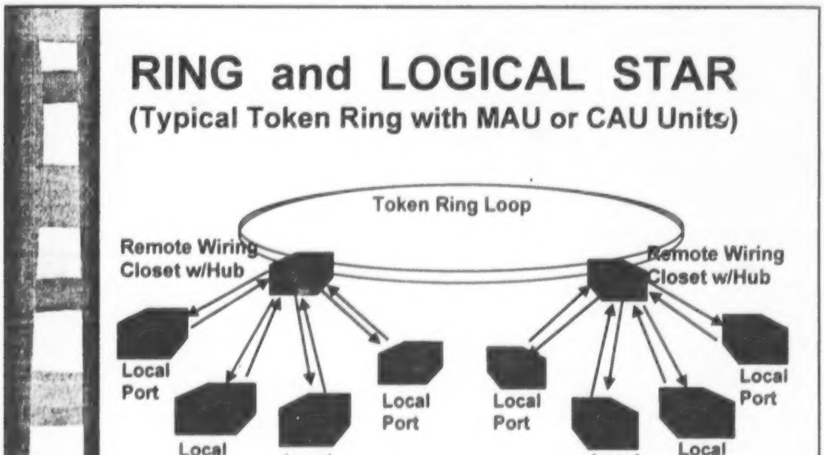
Remote Wiring Closet w/Hub

Local Port

Local Port

Local Port

Local Port



RING and LOGICAL STAR

(Typical Token Ring with MAU or CAU Units)

Token Ring Loop

Remote Wiring Closet w/Hub

Local Port

Local Port

Local Port

Local Port

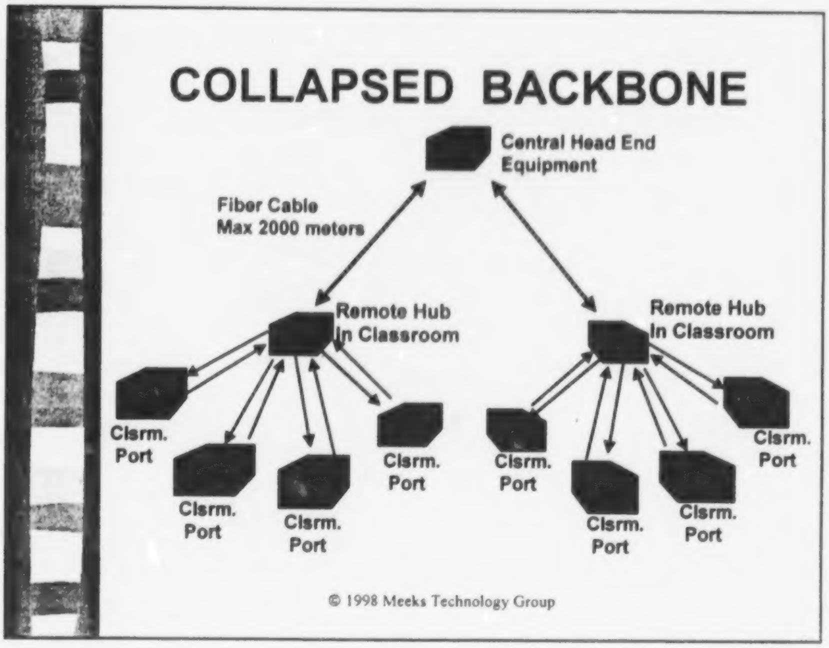
Remote Wiring Closet w/Hub

Local Port

Local Port

Local Port

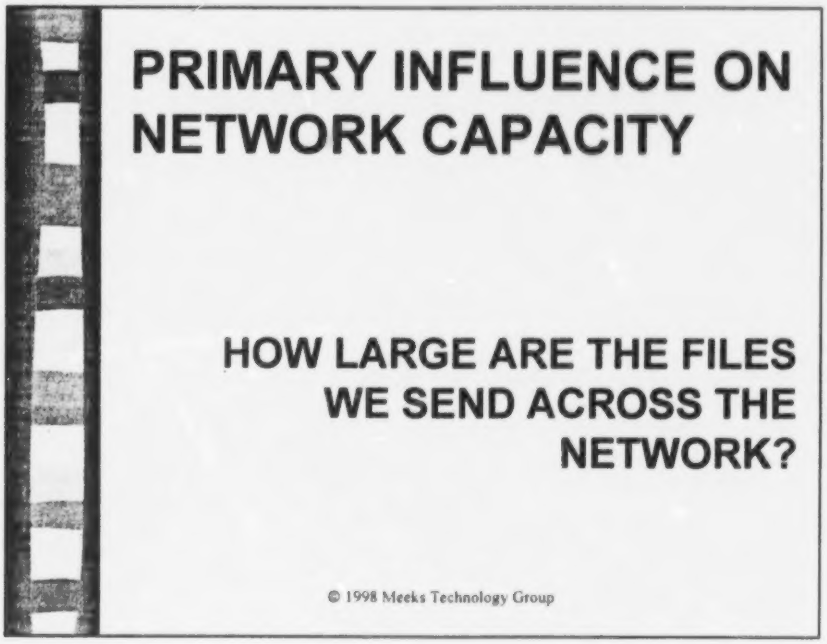
Local Port



COLLAPSED BACKBONE

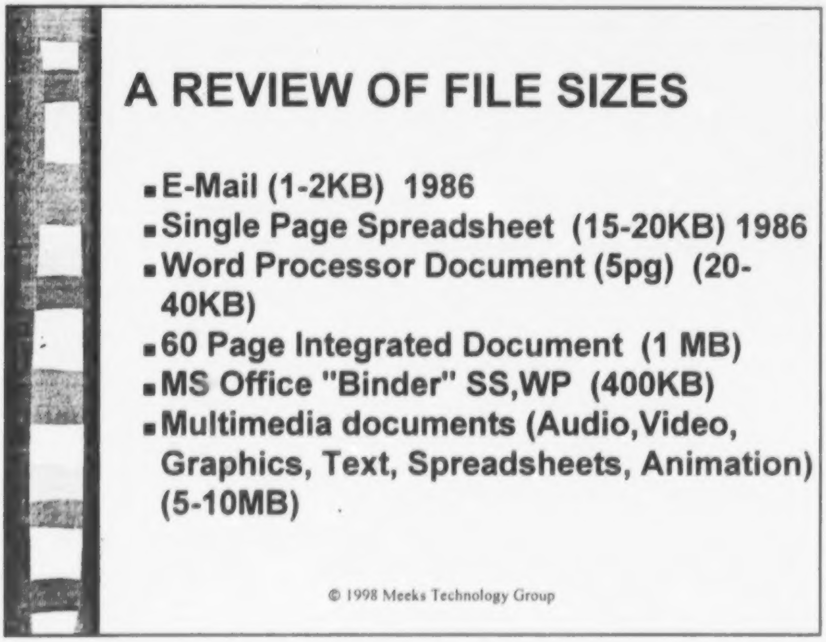
COST COMPARISON

▪ Distributed Ethernet (Wiring Closets)	▪ Collapsed Backbone
- 4 Cat 5 @ 200 Ft	- 4 F.O. Strands @200 Ft.
- 20% Wastage = 40 Ft	- 20% Wastage = 40 Ft
- 960 Ft @ $.38/Ft ($365)	- 240 Ft @ $.95/Ft ($228)
- 8 hours/1000 Ft	- 8 Hours / 1000 Ft
- @ $40/hr ($320)	- 2.5 hrs @ $40/hr ($100)
- Total Cost $685	- Total Cost $328
- Contractor Mark-up 1.4	- Contractor Mark-up 1.4
- $959	- $460



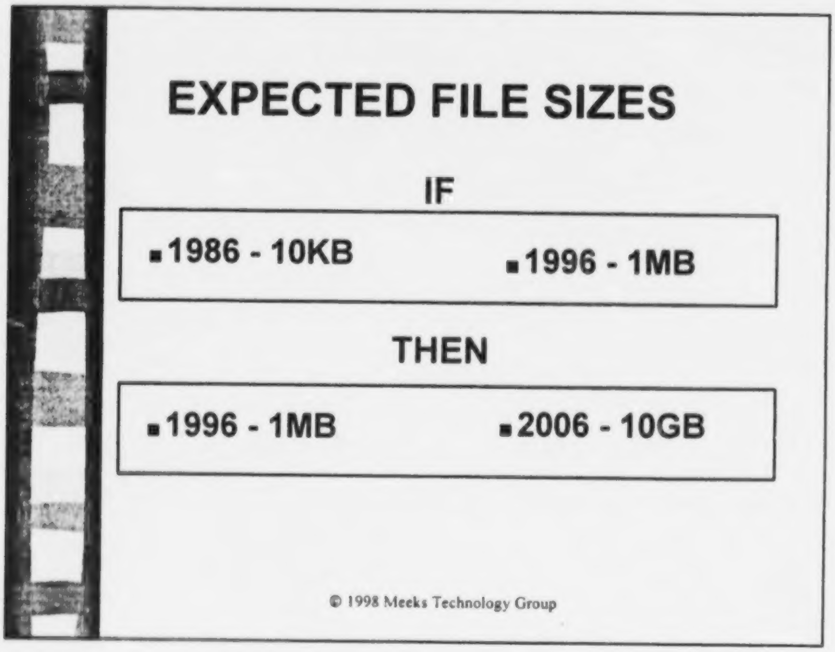
PRIMARY INFLUENCE ON NETWORK CAPACITY

HOW LARGE ARE THE FILES WE SEND ACROSS THE NETWORK?



A REVIEW OF FILE SIZES

- E-Mail (1-2KB) 1986
- Single Page Spreadsheet (15-20KB) 1986
- Word Processor Document (5pg) (20-40KB)
- 60 Page Integrated Document (1 MB)
- MS Office "Binder" SS,WP (400KB)
- Multimedia documents (Audio,Video, Graphics, Text, Spreadsheets, Animation) (5-10MB)



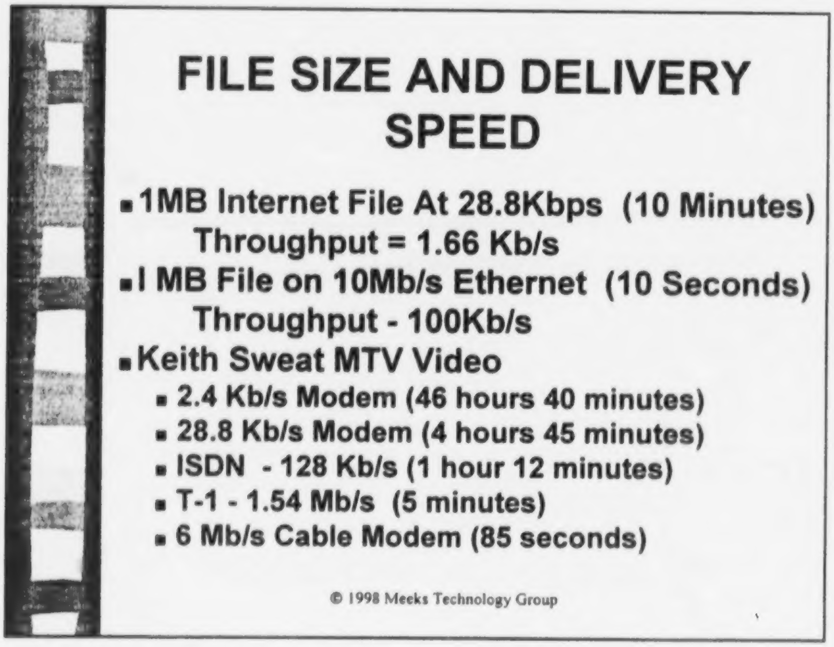
EXPECTED FILE SIZES

IF

- 1986 - 10KB
- 1996 - 1MB

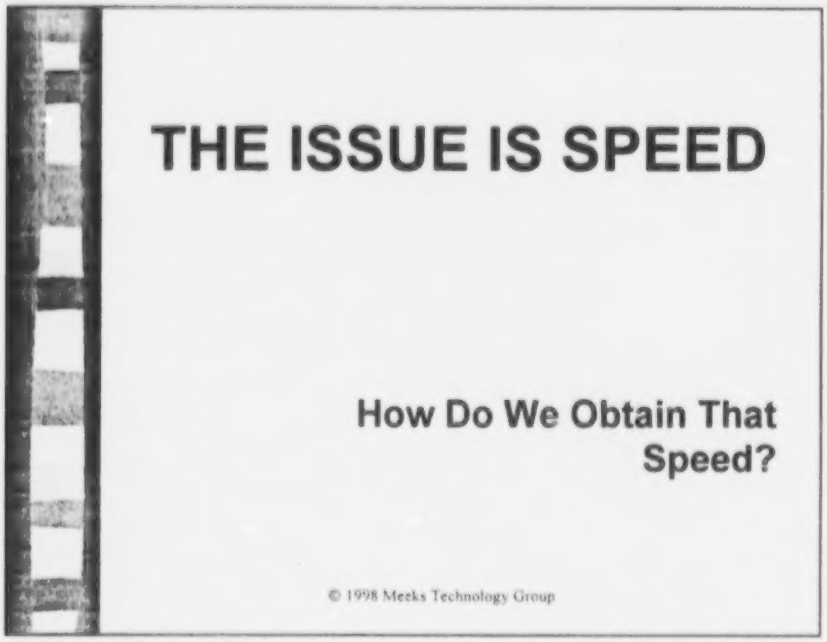
THEN

- 1996 - 1MB
- 2006 - 10GB



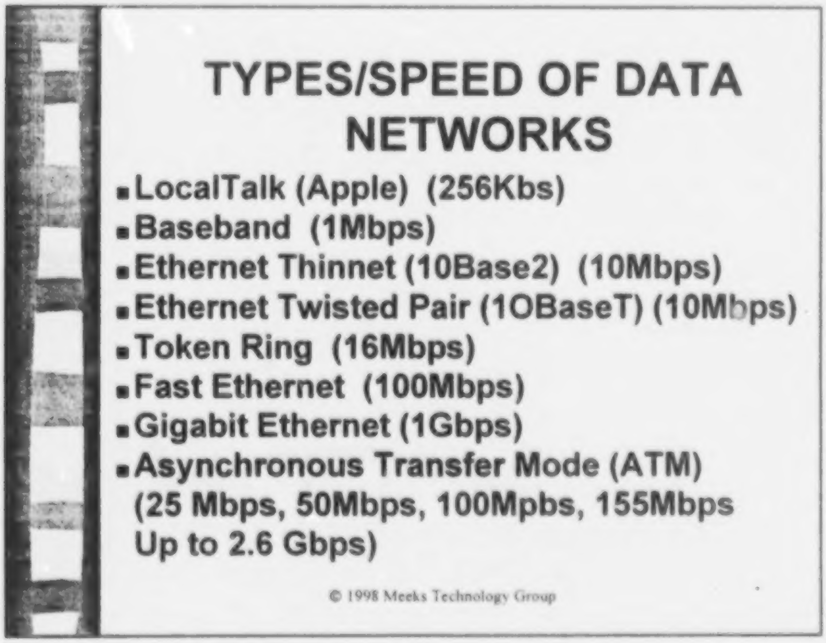
FILE SIZE AND DELIVERY SPEED

- 1MB Internet File At 28.8Kbps (10 Minutes)
  Throughput = 1.66 Kb/s
- I MB File on 10Mb/s Ethernet (10 Seconds)
  Throughput - 100Kb/s
- Keith Sweat MTV Video
  - 2.4 Kb/s Modem (46 hours 40 minutes)
  - 28.8 Kb/s Modem (4 hours 45 minutes)
  - ISDN - 128 Kb/s (1 hour 12 minutes)
  - T-1 - 1.54 Mb/s (5 minutes)
  - 6 Mb/s Cable Modem (85 seconds)



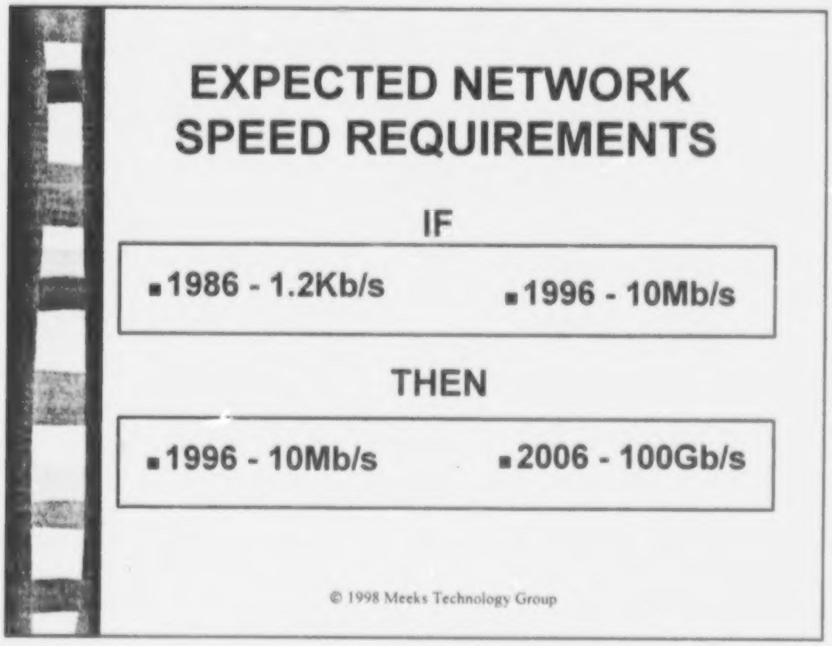
THE ISSUE IS SPEED

How Do We Obtain That Speed?



TYPES/SPEED OF DATA NETWORKS

- LocalTalk (Apple) (256Kbs)
- Baseband (1Mbps)
- Ethernet Thinnet (10Base2) (10Mbps)
- Ethernet Twisted Pair (1OBaseT) (10Mbps)
- Token Ring (16Mbps)
- Fast Ethernet (100Mbps)
- Gigabit Ethernet (1Gbps)
- Asynchronous Transfer Mode (ATM) (25 Mbps, 50Mbps, 100Mpbs, 155Mbps Up to 2.6 Gbps)



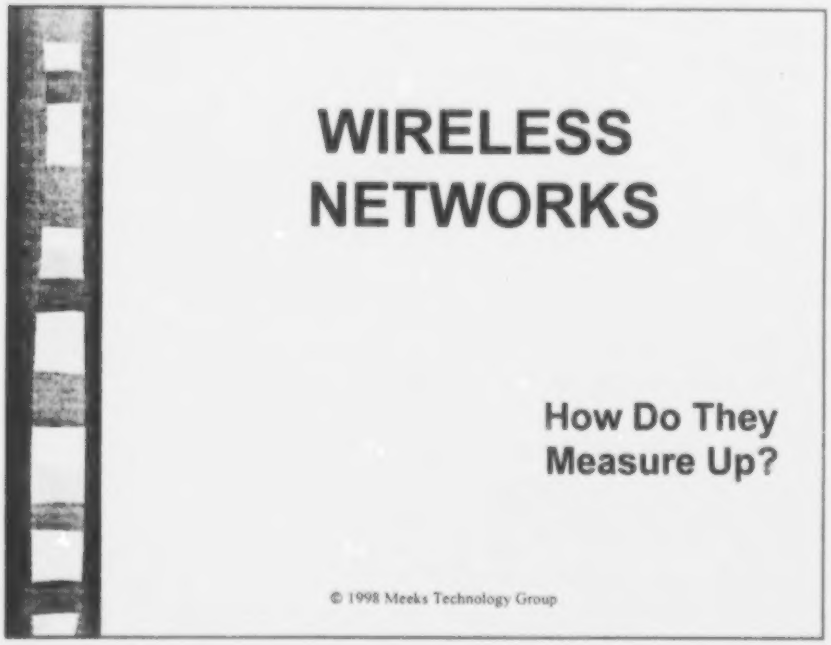
EXPECTED NETWORK SPEED REQUIREMENTS

IF

- 1986 - 1.2Kb/s
- 1996 - 10Mb/s

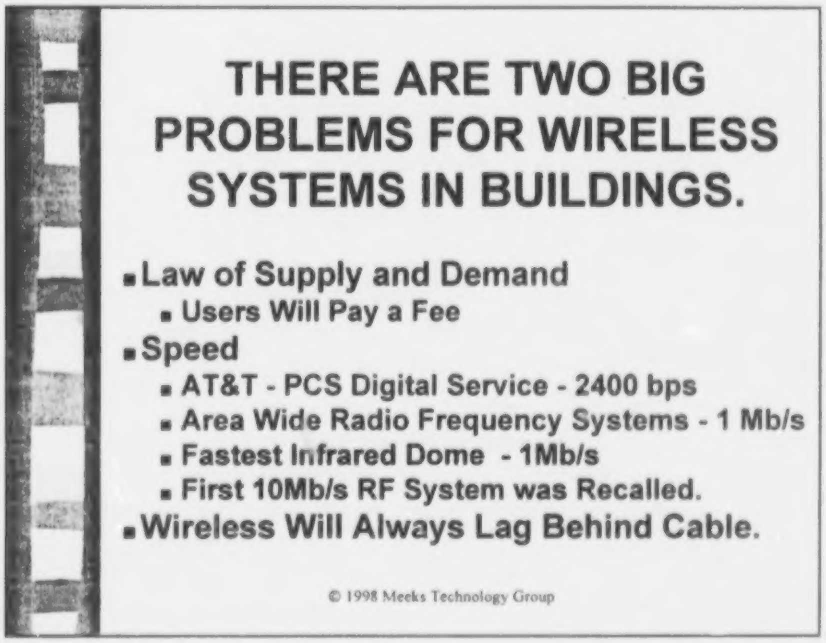
THEN

- 1996 - 10Mb/s
- 2006 - 100Gb/s



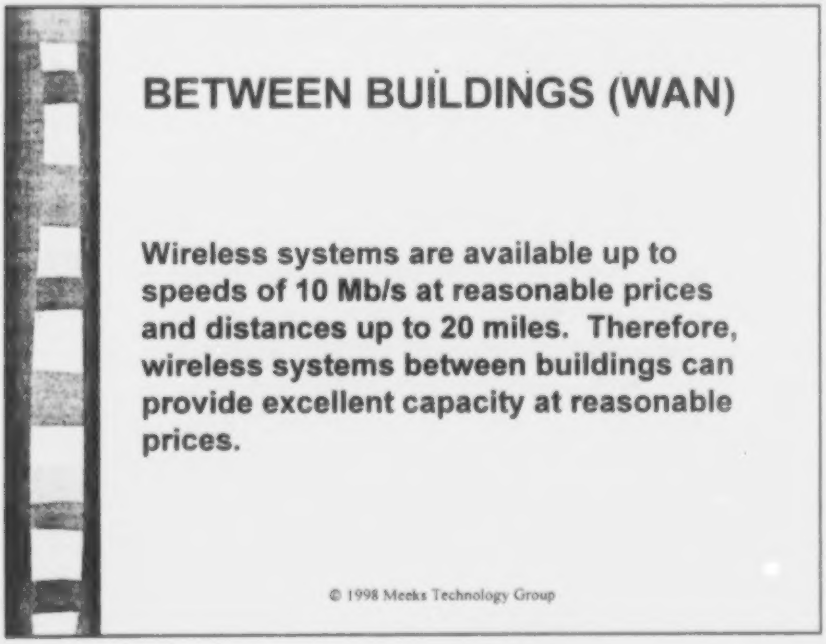
WIRELESS NETWORKS

How Do They Measure Up?



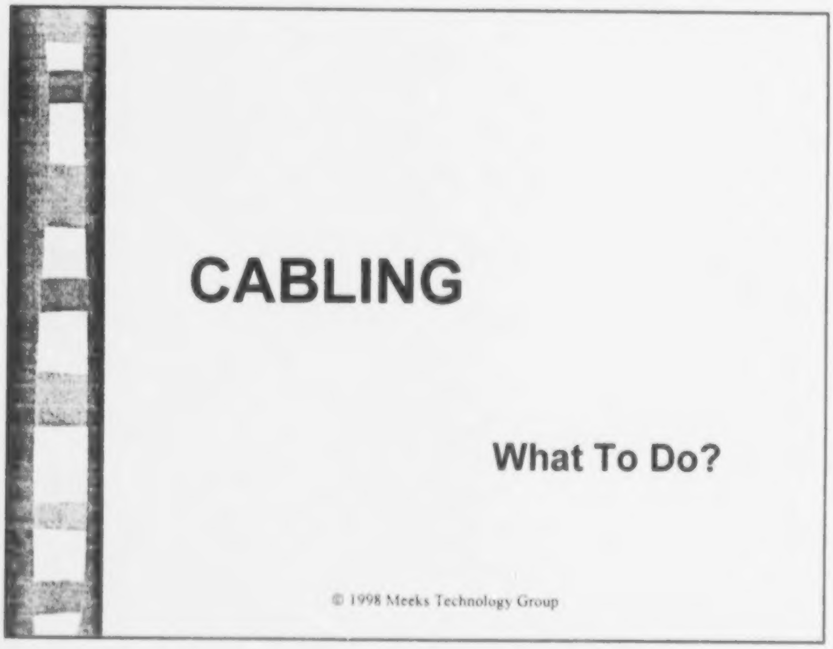
THERE ARE TWO BIG PROBLEMS FOR WIRELESS SYSTEMS IN BUILDINGS.

- Law of Supply and Demand
  - Users Will Pay a Fee
- Speed
  - AT&T - PCS Digital Service - 2400 bps
  - Area Wide Radio Frequency Systems - 1 Mb/s
  - Fastest Infrared Dome - 1Mb/s
  - First 10Mb/s RF System was Recalled.
- Wireless Will Always Lag Behind Cable.



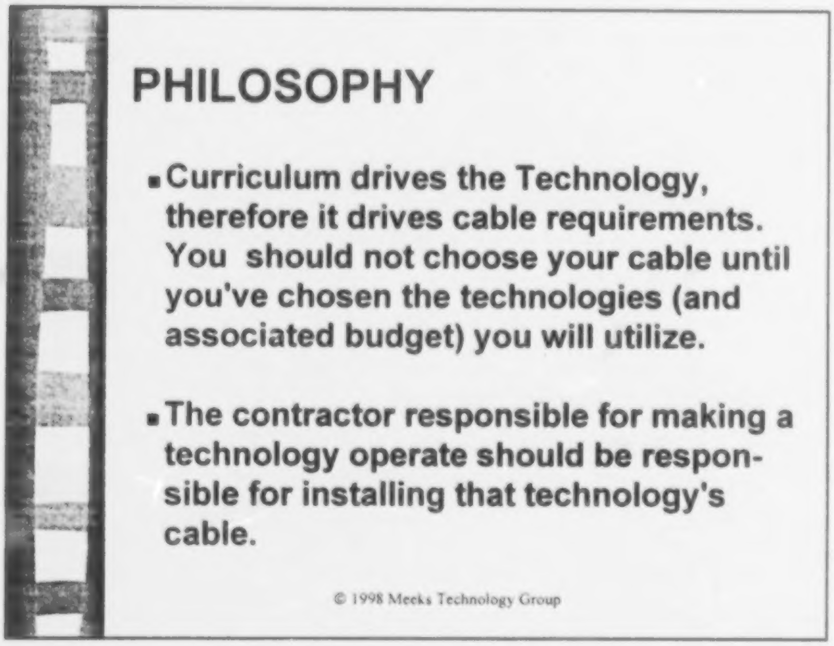
BETWEEN BUILDINGS (WAN)

Wireless systems are available up to speeds of 10 Mb/s at reasonable prices and distances up to 20 miles. Therefore, wireless systems between buildings can provide excellent capacity at reasonable prices.



CABLING

What To Do?



PHILOSOPHY

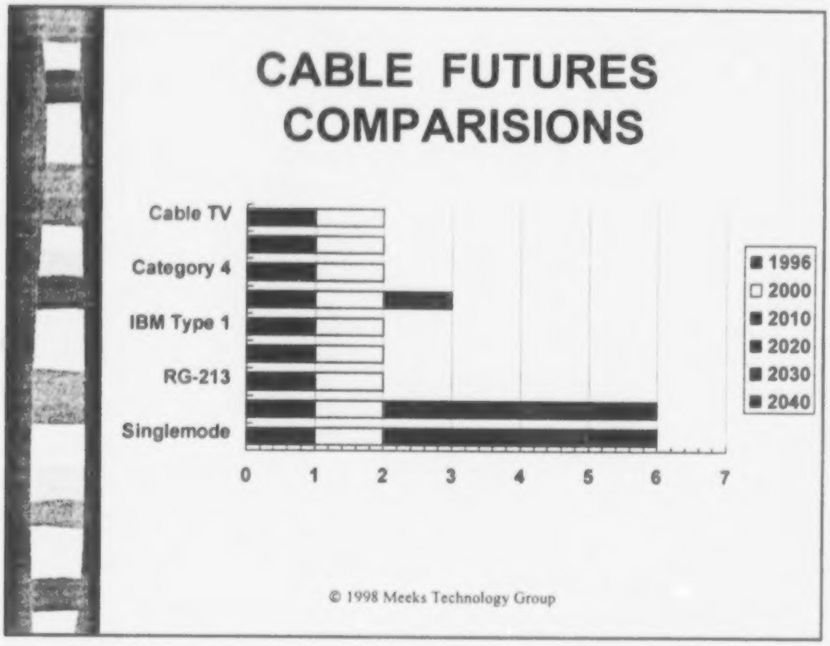
- Curriculum drives the Technology, therefore it drives cable requirements. You should not choose your cable until you've chosen the technologies (and associated budget) you will utilize.
- The contractor responsible for making a technology operate should be responsible for installing that technology's cable.

CABLE TYPES

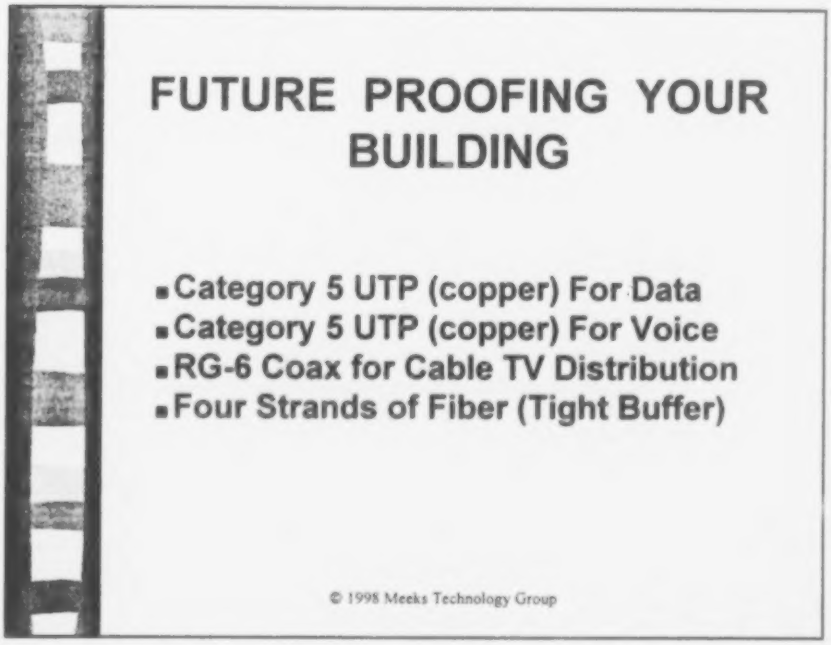
	MHz	Mbps	Distance	Network
Category 1	.15	NAObsolete	NA	Voice Only
Category 2	1	1 Obsolete	100m	Baseband
Category 3	16	10	100m	Ethernet
Category 4	20	16	100m	Token Ring
Category 5	100	155	100m	All
IBM Type 1	20	16	100m	Token Ring
RG-58 Coax	16	10	185m	Ethernet
RG-213	16	10	500m	Ethernet
Cable TV	300	.056 to 10	400m	NA

FIBER OPTIC CABLE

	MHz	Mbps	Distance	Source
Multimode	600	1Gbs+?	5km	LED
Singlemode	1400	3Gbs+?	50km	Laser

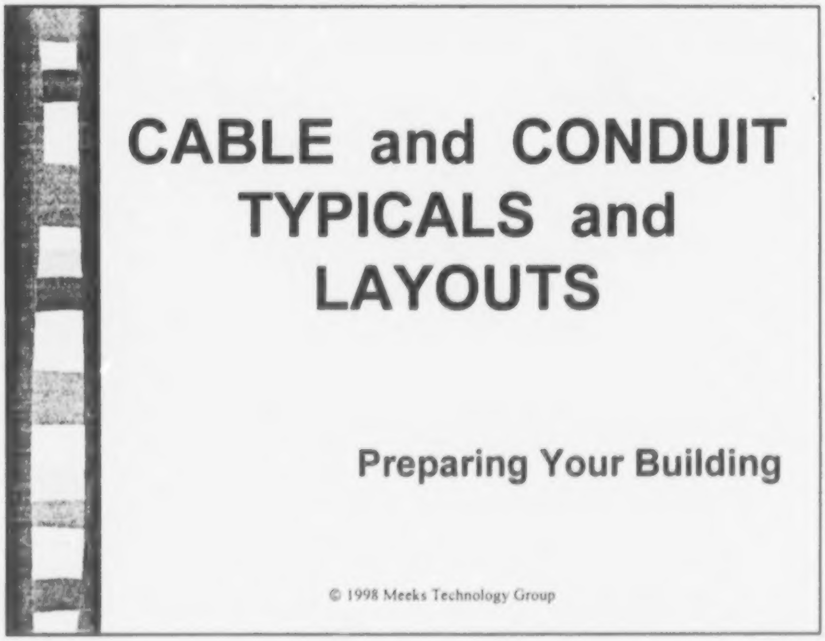


CABLE FUTURES COMPARISIONS



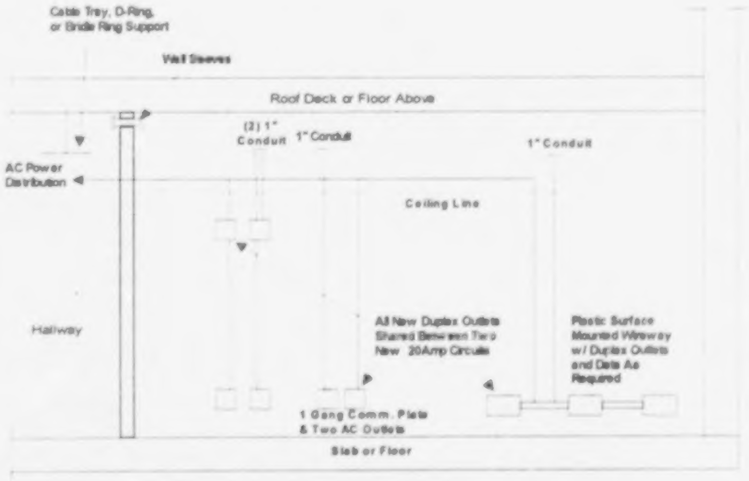
FUTURE PROOFING YOUR BUILDING

- Category 5 UTP (copper) For Data
- Category 5 UTP (copper) For Voice
- RG-6 Coax for Cable TV Distribution
- Four Strands of Fiber (Tight Buffer)



CABLE and CONDUIT TYPICALS and LAYOUTS

Preparing Your Building


Cable Tray, D-Ring,
or Bridle Ring Support
Wall Sleeves
Roof Deck or Floor Above
(2) 1" Conduit
1" Conduit
1" Conduit
AC Power Distribution
Ceiling Line
Hallway
All New Duplex Outlets Shared Between Two New 20Amp Circuits
Plastic Surface Mounted Wireway w/ Duplex Outlets and Data As Required
1 Gang Comm. Plate & Two AC Outlets
Slab or Floor

CONCEPTUAL DIAGRAM - INFRASTRUCTURE CAPACITY
TYPICAL INSTRUCTIONAL SPACE

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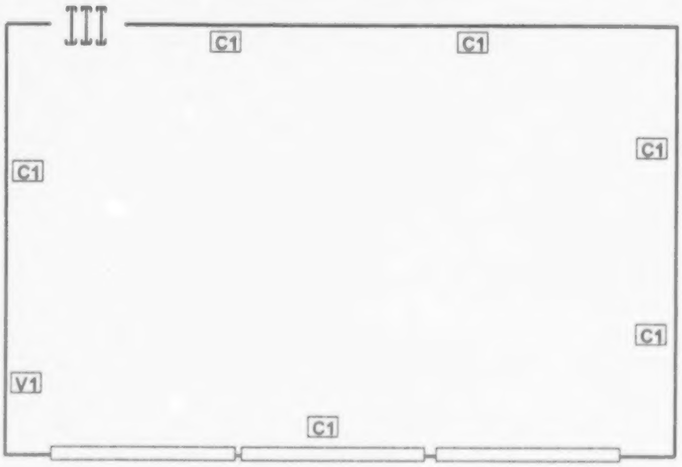
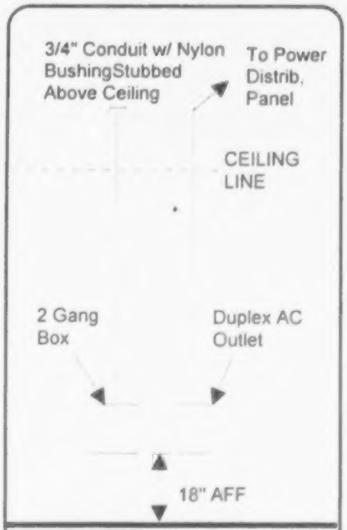
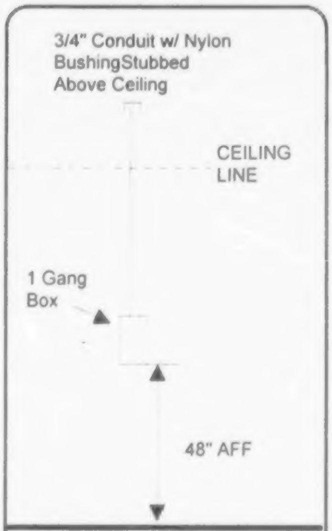
TYPICAL CLASSROOM LAYOUT





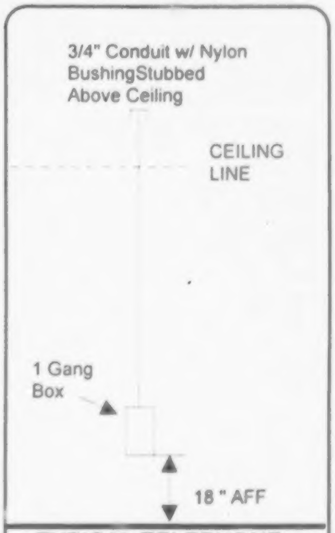
TYPICAL DATA TELEPHONE LOCATION

SYMBOL **C1**



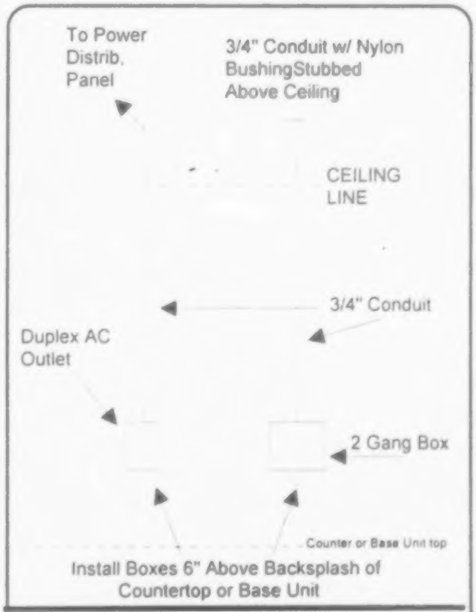
TYPICAL WALL MOUNTED TELEPHONE LOCATION

SYMBOL **C4**



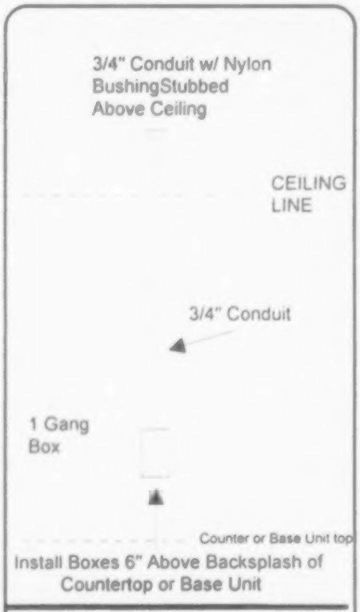
TYPICAL TELEPHONE LOCATION

SYMBOL **C3**



TYPICAL COUNTERTOP DATA TELEPHONE LOCATION

SYMBOL **C1C**



TYPICAL COUNTERTOP TELEPHONE LOCATION

SYMBOL **C3C**

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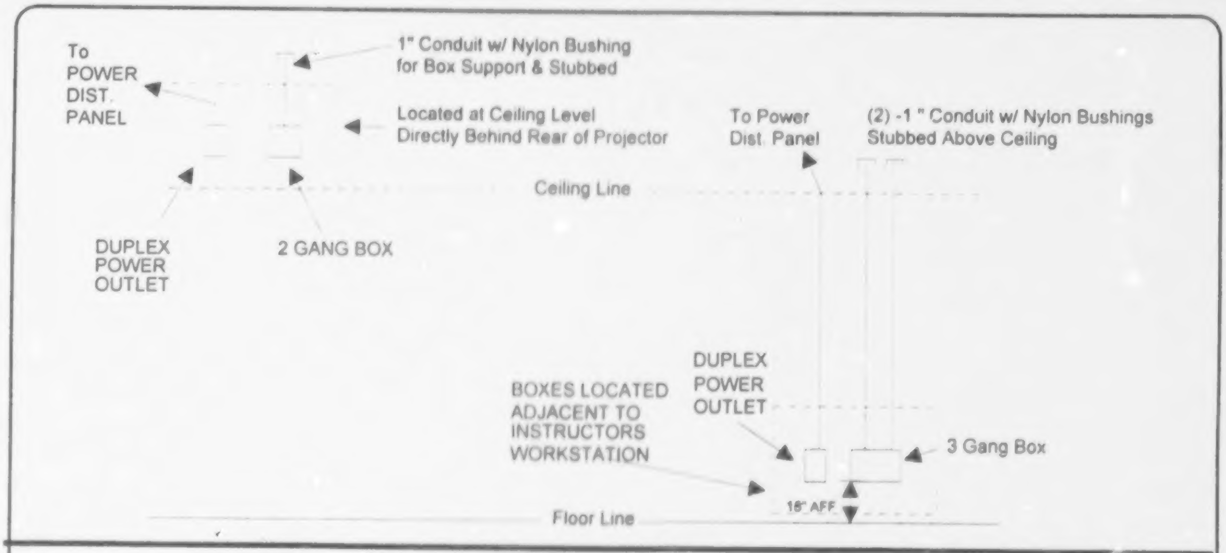
01

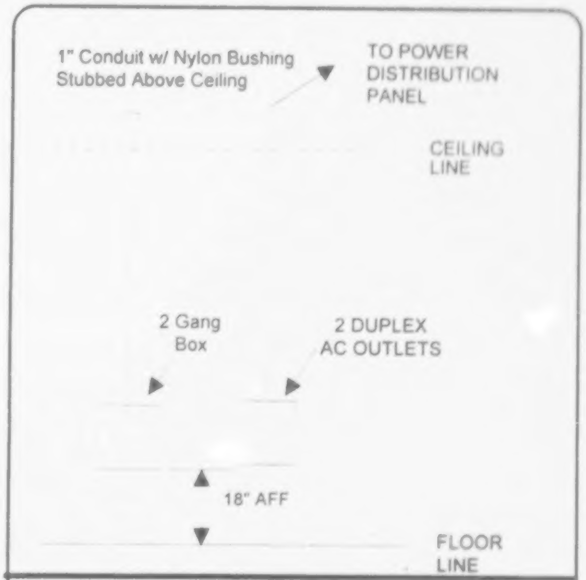
TITLE: CONDUIT - INFRASTRUCTURE TELEPHONE
PROJECT: MTG - Standards
DATE: 1/5/97 BY: GEM

MEEKS TECHNOLOGY GROUP
209 New Edition Ct. - Cary, NC 27511
919.468-9595


To POWER DIST. PANEL
1" Conduit w/ Nylon Bushing for Box Support & Stubbed
Located at Ceiling Level Directly Behind Rear of Projector
To Power Dist. Panel
(2) -1 " Conduit w/ Nylon Bushings Stubbed Above Ceiling
Ceiling Line
DUPLEX POWER OUTLET
2 GANG BOX
DUPLEX POWER OUTLET
BOXES LOCATED ADJACENT TO INSTRUCTORS WORKSTATION
3 Gang Box
18" AFF
Floor Line

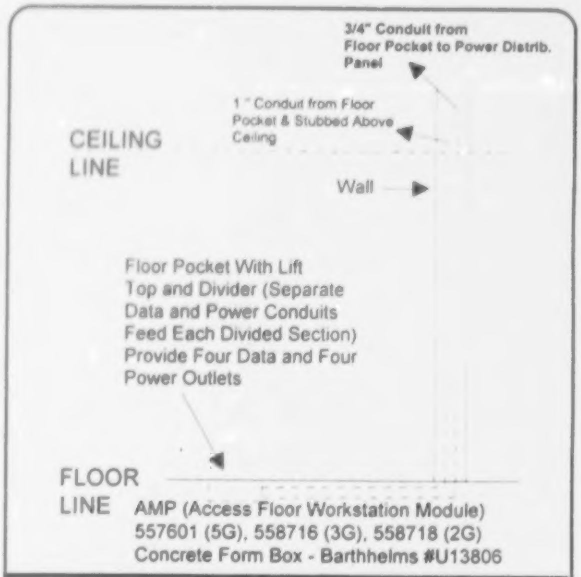
TYPICAL CEILING VIDEO PROJECTOR LOCATION

SYMBOL **CVP**


1" Conduit w/ Nylon Bushing Stubbed Above Ceiling
TO POWER DISTRIBUTION PANEL
CEILING LINE
2 Gang Box
2 DUPLEX AC OUTLETS
18" AFF
FLOOR LINE

TYPICAL DATA LOCATION

SYMBOL **C2**


3/4" Conduit from Floor Pocket to Power Distrib. Panel
1 " Conduit from Floor Pocket & Stubbed Above Ceiling
CEILING LINE
Wall
Floor Pocket With Lift Top and Divider (Separate Data and Power Conduits Feed Each Divided Section) Provide Four Data and Four Power Outlets
FLOOR LINE
AMP (Access Floor Workstation Module)
557601 (5G), 558716 (3G), 558718 (2G)
Concrete Form Box - Barthhelms #U13806

TYPICAL FLOOR POCKET DATA LOCATION

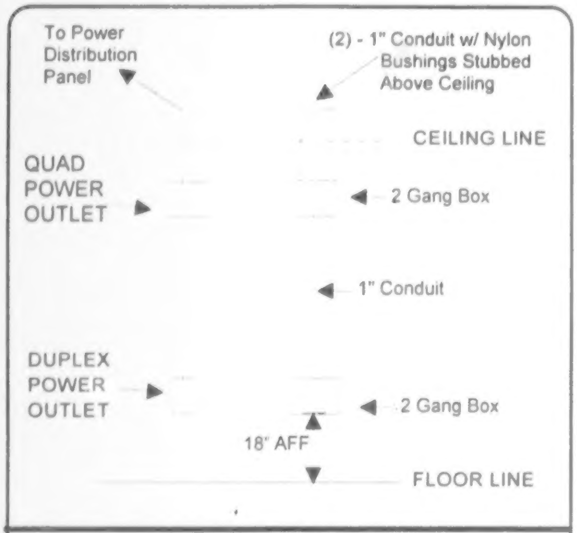
SYMBOL **FP**

TITLE:
CONDUIT
DATA TYPICALS #2

PROJECT MTG - Standards

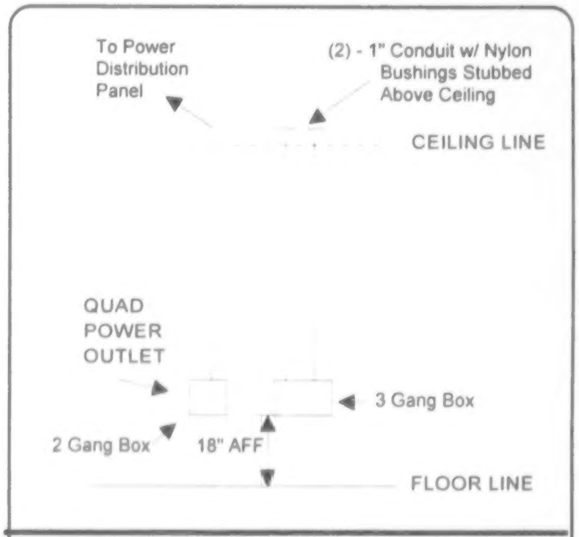
DATE: 1/5/97 BY: GEM

MEEKS
TECHNOLOGY
GROUP
209 New Edition Ct. - Cary, NC 27511
919.468-9595



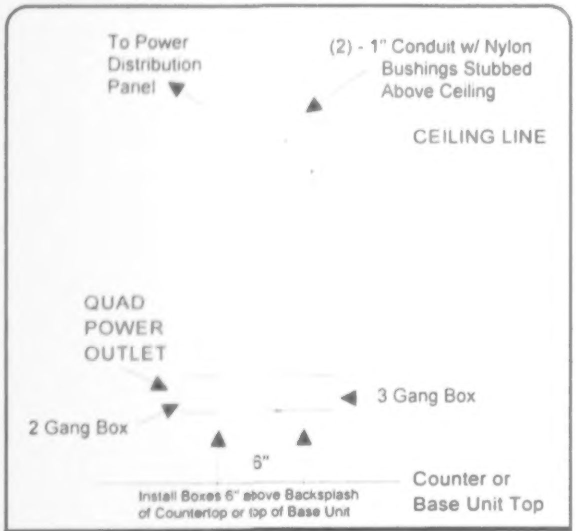
TYPICAL VIDEO LOCATION

Symbol **V1**



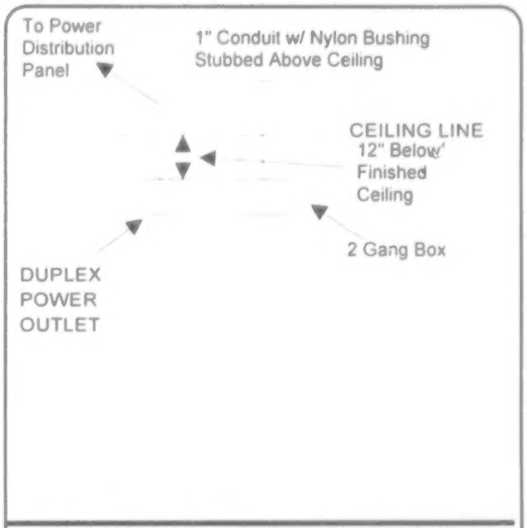
TYPICAL VIDEO PORT LOCATION

Symbol **VP**



TYPICAL DESKTOP VIDEO LOCATION

Symbol **VPC**



TYPICAL VIDEO DISPLAY LOCATION

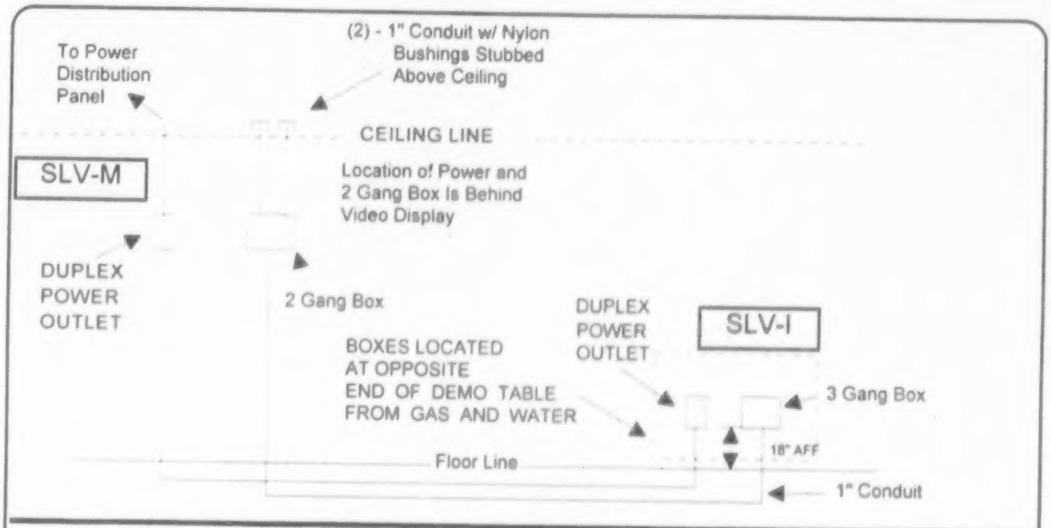
Symbol **VD**

TITLE:
CONDUIT - INFRASTRUCTURE
VIDEO TYPICALS

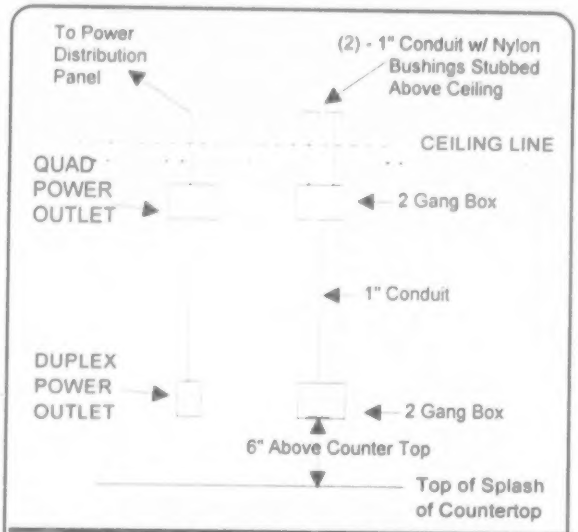
PROJECT: MTG - Standards

DATE: 1/25/97 BY: GEM

MEEKS
TECHNOLOGY
GROUP
209 New Edition Ct. - Cary, NC 27511
919.468-9595


(2) - 1" Conduit w/ Nylon Bushings Stubbed Above Ceiling
To Power Distribution Panel
CEILING LINE
SLV-M
Location of Power and 2 Gang Box Is Behind Video Display
DUPLEX POWER OUTLET
2 Gang Box
DUPLEX POWER OUTLET
SLV-I
BOXES LOCATED AT OPPOSITE END OF DEMO TABLE FROM GAS AND WATER
3 Gang Box
18" AFF
Floor Line
1" Conduit

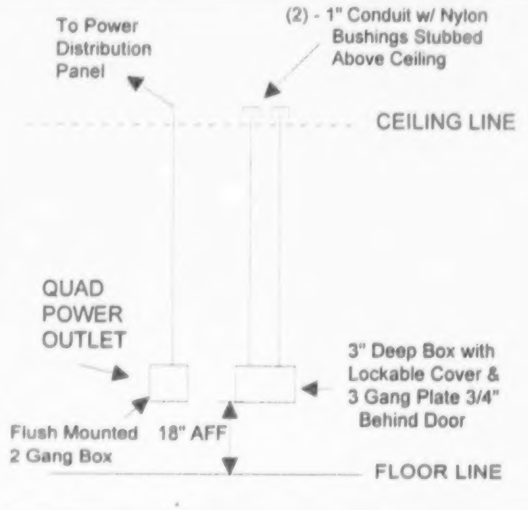
TYPICAL VIDEO DISPLAY LOCATION
SCIENCE LAB **SLV**


To Power Distribution Panel
(2) - 1" Conduit w/ Nylon Bushings Stubbed Above Ceiling
CEILING LINE
QUAD POWER OUTLET
2 Gang Box
1" Conduit
DUPLEX POWER OUTLET
2 Gang Box
6" Above Counter Top
Top of Splash of Countertop

TYPICAL VIDEO LOCATION
COUNTERTOP Symbol **CIC**

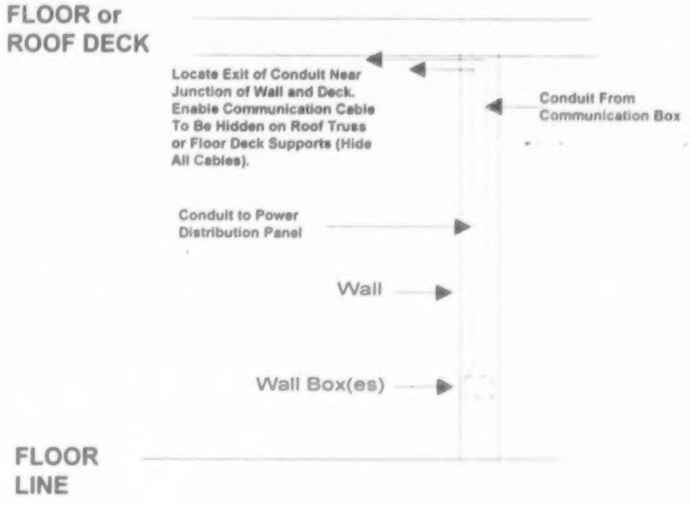
TITLE: CONDUIT - INFRASTRUCTURE TYPICALS - VIDEO #2
PROJECT: MTG - Standards
DATE: 1/11/97 BY: GEM

MEEKS TECHNOLOGY GROUP
209 New Edition Ct. - Cary, NC 27511
919.468-9595



TYPICAL PROTECTED VIDEO PORT LOCATION

Symbol **PVP**


FLOOR or
ROOF DECK
Locate Exit of Conduit Near Junction of Wall and Deck. Enable Communication Cable To Be Hidden on Roof Truss or Floor Deck Supports (Hide All Cables).
Conduit From
Communication Box
Conduit to Power
Distribution Panel
Wall
Wall Box(es)
FLOOR
LINE

TYPICAL CONDITION - NO CEILING SYSTEM

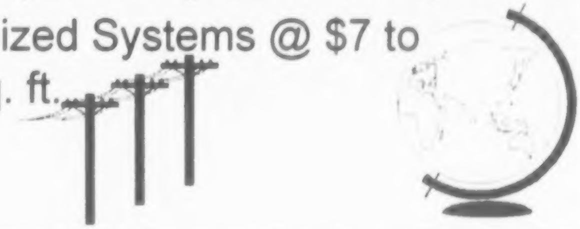
BEST COPY AVAILABLE

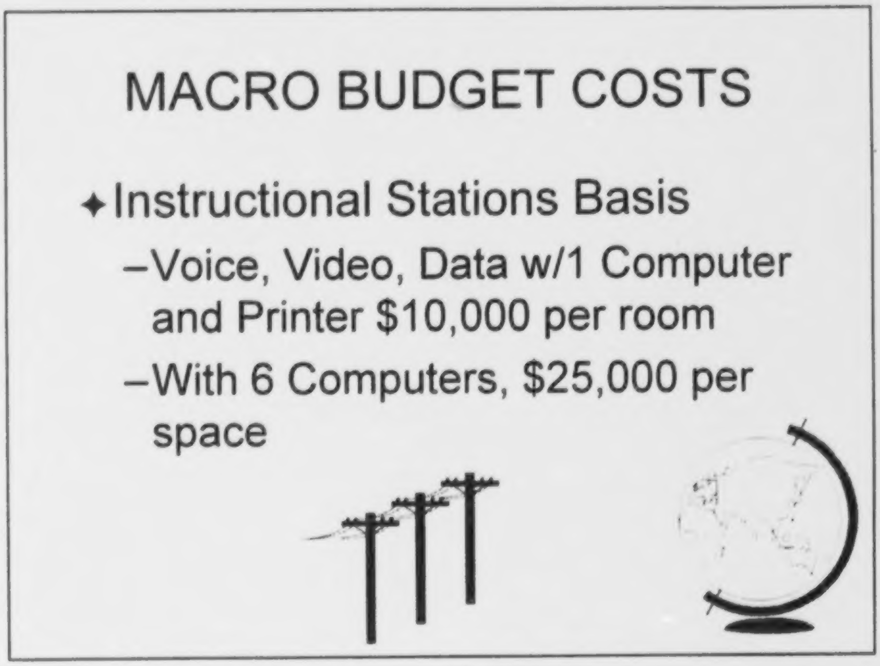
TITLE: CONDUIT - INFRASTRUCTURE New Construction	MEEKS TECHNOLOGY GROUP 209 New Edition Ct. - Cary, NC 27511 919.468.9595
PROJECT MTG - Standards	
DATE 1/22/97 BY GEM	

IMPLEMENTATION COSTS FOR EDUCATIONAL TECHNOLOGY SYSTEMS

MACRO BUDGET COSTS

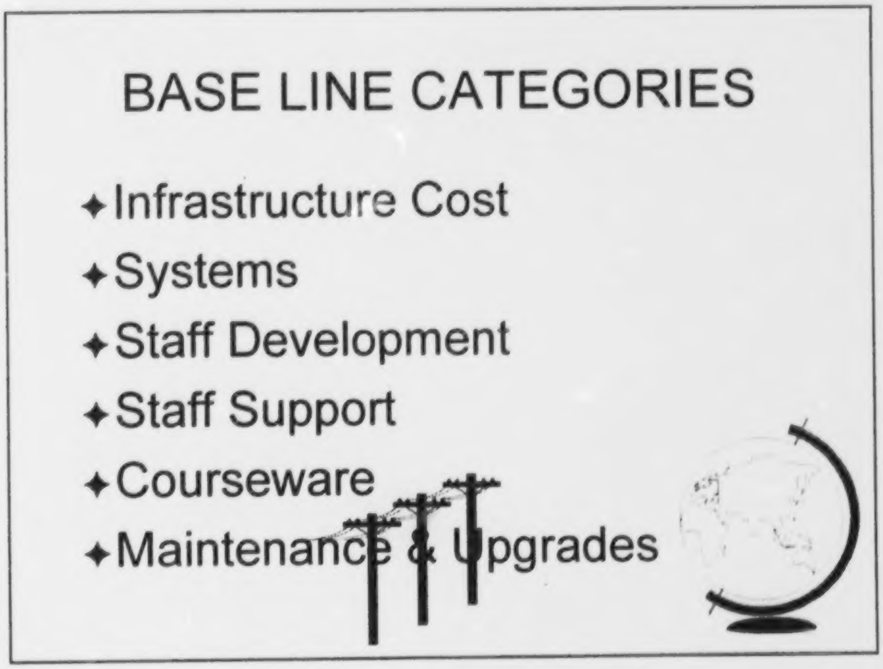
- Per Student Basis - $1500 to $2000
- Square Footage Basis
  - –Basic Systems @ $3 to $5/sq. ft.
  - –Maximized Systems @ $7 to $10/sq. ft.





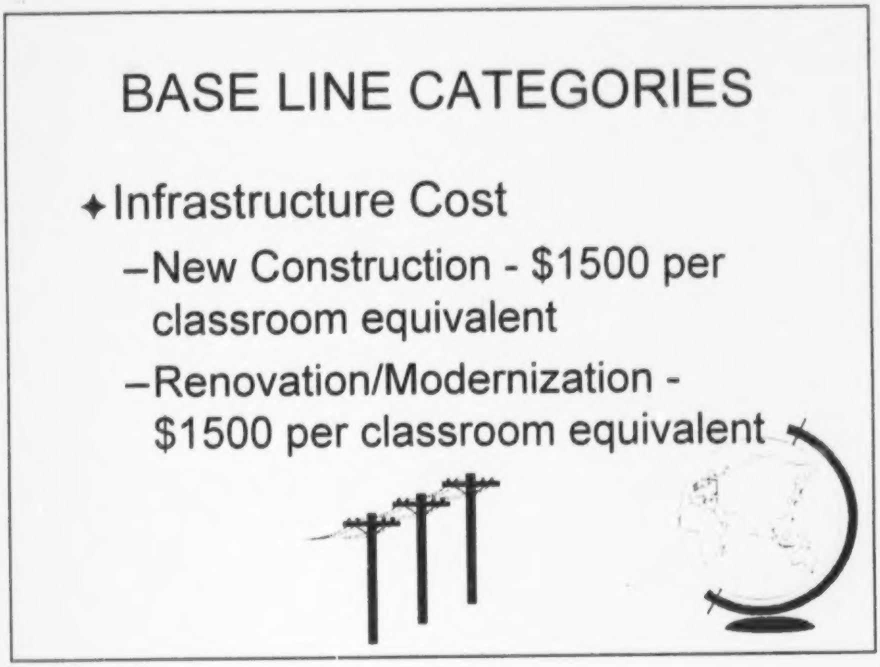
MACRO BUDGET COSTS

- ✦ Instructional Stations Basis
  - –Voice, Video, Data w/1 Computer and Printer $10,000 per room
  - –With 6 Computers, $25,000 per space



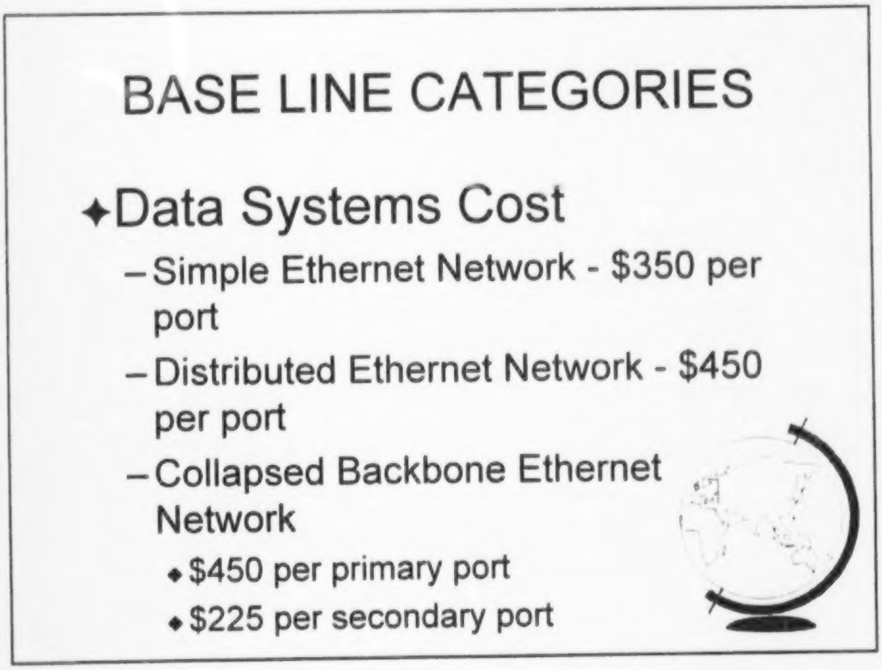
BASE LINE CATEGORIES

- ✦ Infrastructure Cost
- ✦ Systems
- ✦ Staff Development
- ✦ Staff Support
- ✦ Courseware
- ✦ Maintenance & Upgrades



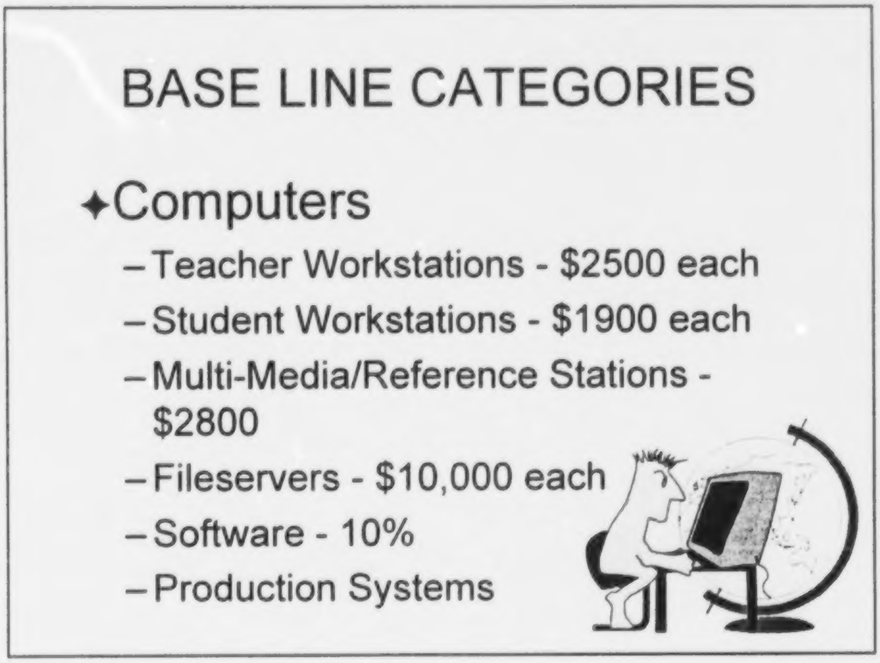
BASE LINE CATEGORIES

- Infrastructure Cost
  - New Construction - $1500 per classroom equivalent
  - Renovation/Modernization - $1500 per classroom equivalent



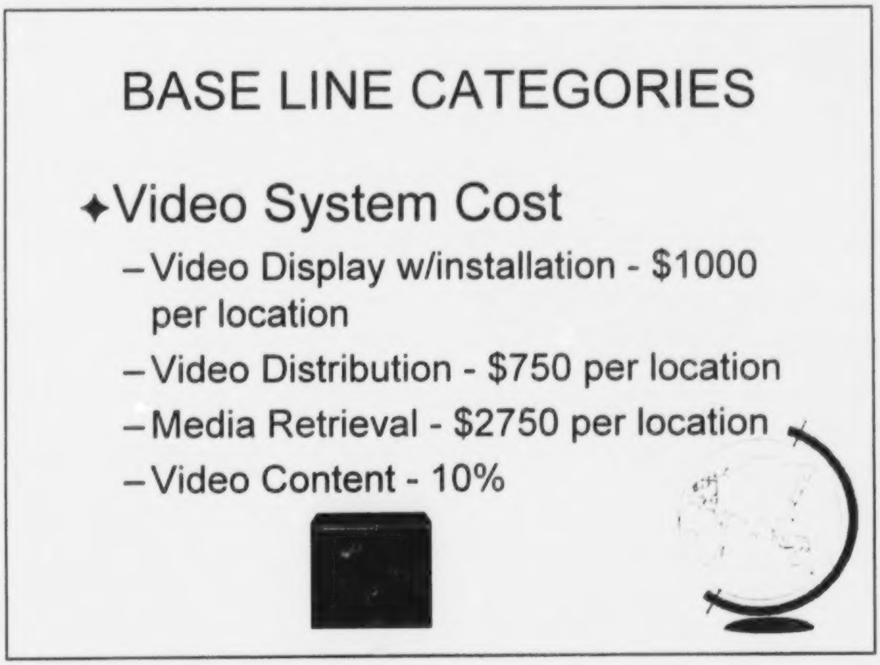
BASE LINE CATEGORIES

- Data Systems Cost
  - Simple Ethernet Network - $350 per port
  - Distributed Ethernet Network - $450 per port
  - Collapsed Backbone Ethernet Network
    - $450 per primary port
    - $225 per secondary port



BASE LINE CATEGORIES

- Computers
  - Teacher Workstations - $2500 each
  - Student Workstations - $1900 each
  - Multi-Media/Reference Stations - $2800
  - Fileservers - $10,000 each
  - Software - 10%
  - Production Systems

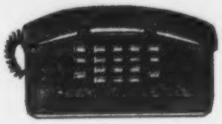


BASE LINE CATEGORIES

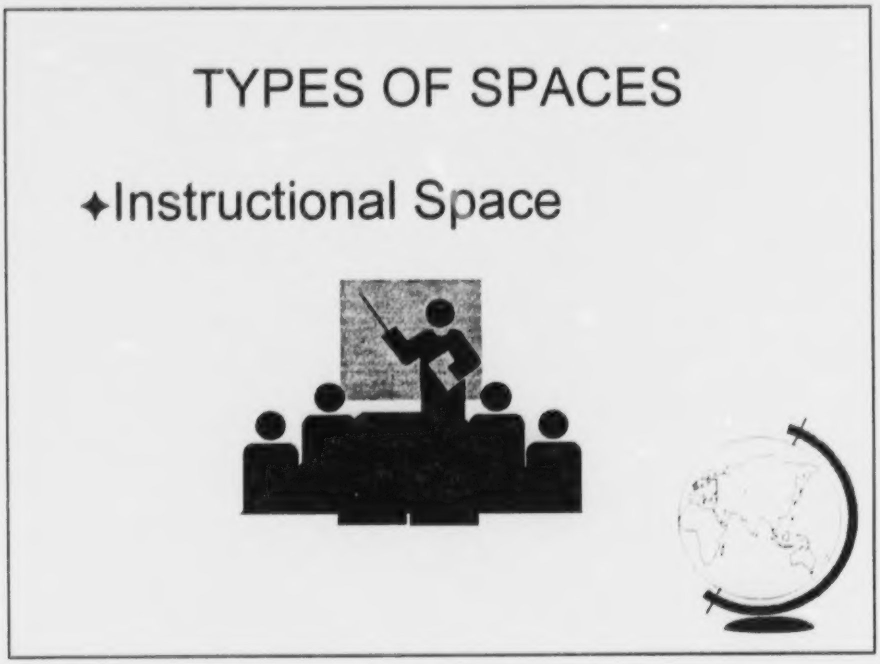
- Video System Cost
  - Video Display w/installation - $1000 per location
  - Video Distribution - $750 per location
  - Media Retrieval - $2750 per location
  - Video Content - 10%

BASE LINE CATEGORIES

✦Voice System Cost
  - Public Address Systems - $150 per speaker
  - PBX Phone System - $500 per line
  - Voice Mail Systems - $8K, 12K, 16K

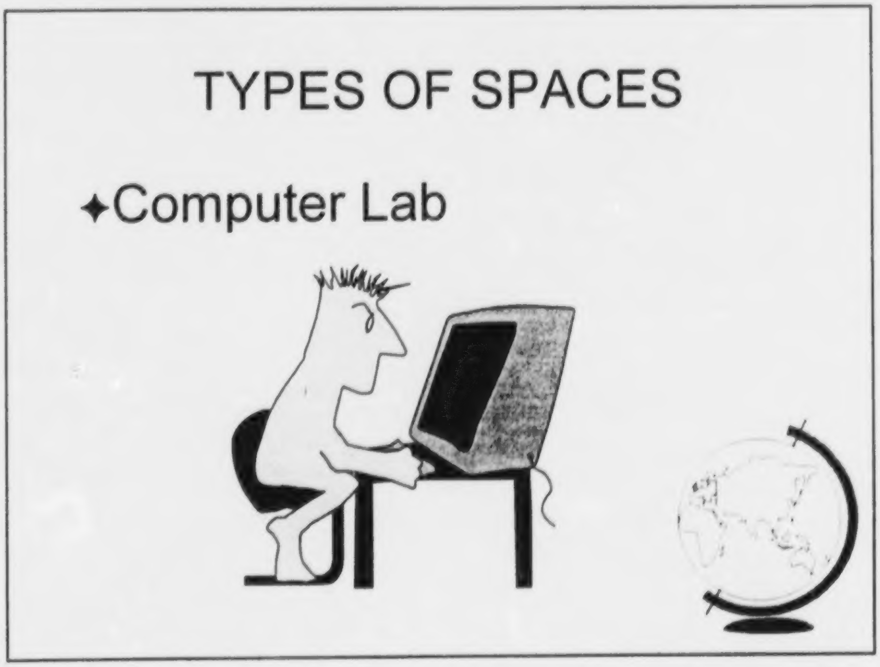


Determining Types and Quantities of Spaces



TYPES OF SPACES

- ✦Instructional Space

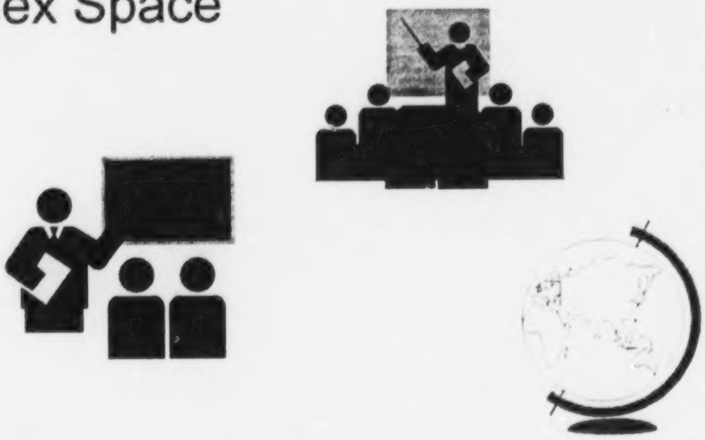


TYPES OF SPACES

- ✦Computer Lab

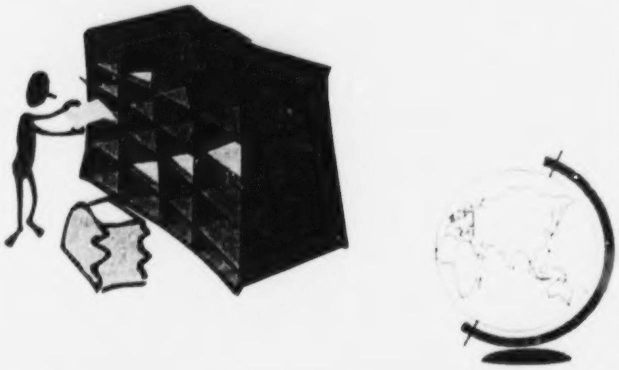
TYPES OF SPACES

- ✦Flex Space



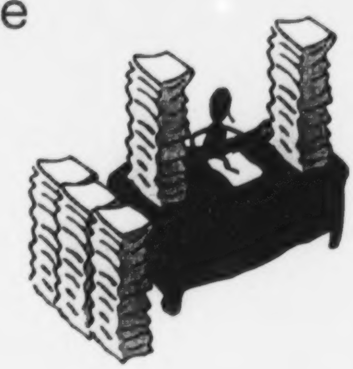
TYPES OF SPACES

- ✦Media Center



TYPES OF SPACES

- Office



QUANTITY OF SPACES

- 1 Classroom = 1 Classroom
- 1Computer Lab = 2 Classrooms
- 3 Flex Spaces = 1 Classroom
- 6 Offices = 1 Classroom
- 1 Media Center = 2 Classrooms

CEFPI
The School Building Association

ISSUETRAK

A CEFPI Brief on Educational Facility Issues

Topic : Implementation Costs for Educational Technology Systems

Issue Trackers: Glenn E. Meeks REFP, Ricki Fisher and Warren Loveless

Date Filed: December 1997

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Based on data from more than thirty projects, we have developed simple cost estimates for technology systems based on a per-port system. Obviously, these costs will vary based on the region of the country you are in and the competency level and quantity of technology contractors available to you. Costs and components for each system listed below are based on facilities in the Midwest with an average of 35 instructional spaces. Please note – as buildings become smaller, the per port price increases.

BASE LINE COST CATEGORIES AND PRICES

Infrastructure

New Construction $1,500 for each classroom equivalent	One additional 20-Amp 110VAC circuit— Six empty data box drops & six duplex outlets.
Renovation/Modernization $3,000 for each classroom equivalent	One new 20-Amp 110VAC circuit— Six empty data box drops & six duplex outlets,surface mounted. NOTE: For additional electrical service to building, add minimum $50,000.

Data Systems

Simple Ethernet Network (One head end) $350 per port.	Includes head end port, patch cord and patch panel, Category 5 copper cable to user port including connectors and labor, jumper cable from wall to computer, and computer set-up.
Distributed Ethernet Network (Head end with remote closets) $450 per port.	Includes head end equipment and fiber port, six strand fiber cable to remote cabinet locations including connectors and labor. Also includes remote data closest location with remote head end port, patch cord and patch panel, Category 5 copper cable to use port including connectors and labor, jumper cable from wall to computer or printer, and set up of printer or computer.
Collapsed Backbone Ethernet Network (Head end with hub in every classroom) $450 for first port (primary) in room; $225 per port (secondary) thereafter.	Includes head end equipment and fiber port for each room, four strand fiber cable to each classroom, connectors and labor for installation, and a small (6 or 8 port) dumb hub in each room. Category 5 copper cable is run from the hub in the room to each data port location required.

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Computers

Teacher Workstations $2,500 each.	Medium high end computer (150 MHz), includes Network Interface Card @ $100 and printer allowance of $400.
Student Workstations $1,900 each.	Lower end computers (100 MHz), includes Network Interface Card @ $100 and printer allowance of $200.
Multi-Media/Reference Stations $2,800 each	High end performance computer with sound board, speakers (headsets), multi-speed CD-ROM drive.
Fileservers $10,000 each	Provide one fileserver for every 50 computers.
Computer Content 10%	Determine total value of computer purchases and add 10% for software content purchases. (Special content—administrative and library software packages are additional costs.)
Production Systems	Video and computer components for students and staff to generate content. Minimum of: $15K/elementary school; $25K/middle school; $40K/high school.

Video System

Video Display with Installation $1,000 per location.	Includes a 31" display installed with monitor mount and local inputs down low for use with movable video equipment
Video Distribution $750 per location.	Includes a coaxial cable TV distribution system throughout facility and one steerable C/Ku satellite antenna with receiver/tuner.
Media Retrieval $2,750 per location.	Includes the head end equipment and source for a media retrieval system.
Video Content	Take 10% of the total video budget and set aside for purchase of video content which is intended for use on the video system.

Voice Systems

Public Address Systems $150 per speaker.	Includes master clock, tone generator, zonal interface, PBX interface, and power amplifier at head end. Additionally, the cable running to the speaker and speaker with back box or surface mounted box are included.
PBX Phone System $500 per line.	Includes PBX switch port, cabling to phone, connectors and labor, and phone instrument. Include four lines for voice mail and the lines coming to the building.
Voice Mail Systems	Add as follows: $8K/elementary school; $12K/middle school; $16K/high school.

Professional Development

	Determine your total budget and set aside 5-10% of it for professional development costs associated with the installation of educational technology systems.

DETERMINING QUANTITIES OF EACH TYPE OF TECHNOLOGY CATEGORY

A feel for the quantity and types of space required is determined during the preliminary stages of project design. These spaces can be divided into the following five types of spaces.

- ***Instructional Space*** — These spaces are defined as any location where student instruction will take place 80% of the school day. For example, classrooms and science labs would be considered instructional spaces. NOTE: Media centers, which contain instruction areas, are considered instructional spaces with extra computers and offices.

- ***Computer Lab*** — Defined as any space with a large concentration of computers where the primary instructional functions are delivered via one computer for every student. These may include smaller project labs (8-12 computers) and larger computer labs (20-35 computer stations).

- ***Flex Space*** — This is a location where instruction utilizes the space for less than 80% of the instructional day but still requires some type of technology support of the instruction program delivered. Typically, these areas include a cafeteria, gymnasium, conference room and/or auditorium.

- ***Media Center*** — Typically, media centers contain multiple implementations of technology. Where applicable, portions of a media center may be considered classrooms, computer labs, or offices. Additionally, these center will have computers related to a library automation system and multi-media stations available for research and remote data access functions.

- ***Office*** — An office is any smaller location which is not typically utilized for instructional functions yet the person occupying the space needs access to a phone and a data port for a computer. The space can be an office, a cubicle, or simply a desk. Personnel (and therefore their spaces) whom we categorize as requiring office space would be administrators, secretaries, counselors, nurses, teacher offices, and custodians.

Based on the instructional or administrative needs of the facility, a simple technology program description must be developed for each type of space. The program description should outline the specific technology planned for the space, [i.e., the Instruction Space will have one teacher computer with a printer, two student computers with one printer (yielding five data ports), a telephone, a video display and output from a video distribution system with media retrieval capacity, and a public address speaker.] Additionally, will you need to upgrade the infrastructure in an existing building or add infrastructure to the scope of a new building?

From the Types of Spaces count and the Technology Program Description of each space, you then can create a matrix which lists the number of ports or components in each space. A subsequent matrix should multiply the number of components times the quantity of each space and then total the ports and components of the same nature. Once you have determined the number of each type of port or component, add 10% spares to the quantity and sum.

DETERMINING EDUCATIONAL TECHNOLOGY BUDGET

- ***Infrastructure***
  To arrive at a total cost of infrastructure, you must determine the number of classroom equivalents. Using a classroom as the base, the cost of all other types of space is calculated as a portion of, or as an increase to a typical classroom. The ratios used are as follows:
  Classroom: 1=1 Computer Lab: 1=2 Flex Space: 3=1 Office: 6=1 Media Center: 1=2

  Once your classroom equivalents have been determined, multiply them times the new construction or renovation cost to determine your infrastructure budget.

- ***Systems***
  To determine your Educational Technology Systems costs, use the total sum of each type of technology port or component, then simply multiply the quantity times the port or component costs. For the computers and video, add in your content and production costs. For the phone, add in your voice-mail costs. Add 5-10% for professional development costs, and 5% of the total as a contingency budget.

By utilizing this macro-budgeting process, you should be able to arrive at an Educational Technology Systems budget that can be used throughout the planning process.

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EDUCATIONAL TECHNOLOGY BUDGET WORKSHEET

PROJECT: New Construction or Renovation

ROOM TOTALS

ROOM TYPE	Quantity	Video Display	Video Distribution	Media Retrieval	Phone	Primary Data port	Secondary Data port	Teacher Workstation	Student Workstation	MultiMedia Workstation	Infrastructure
Instr Spaces											
Computer Lab											
Flex Spaces											
Media Center											
Office											
TOTAL											

Infrastructure: Total Rooms x Infra Cost = Total ________ x ________ = ________

Data Systems: Total Ports x Per Port Cost = Total ________ x ________ = ________

Computers:
Total TWS x Per Unit Cost = Subtotal ________ x ________ = ________
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TOTAL = ________

Video:
Total Displays x Per Unit Cost = Subtotal ________ x ________ = ________
Total Distrib x Per Unit Cost = Subtotal ________ x ________ = ________
Total Media Retrieval x Per Unit Cost = Subtotal ________ x ________ = ________
TOTAL = ________

Voice:
Phones: Total Phones x Per Unit Cost = Total ________ x ________ = ________
Voice Mail: Cost Per School = ________
Public Address: Total Speakers x Per Unit Cost = Total ________ x ________ = ________

Totals:
Infrastructure = ________
Data = ________
Computers = ________
Video = ________
Phones = ________
TECHNOLOGY TOTAL = ________

Software (10%) = ________
Video Content (10%) = ________
Staff Development (5% - 10%) = ________
Contingency (5%) = ________
OTHER TOTAL = ________

PROJECT TOTAL = ________

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Video:
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TOTAL = _____

Voice:
Phones Total Phones x Per Unit Cost = Total _____ x _____ = _____
Voice Mail Cost Per School = _____
Public Address Total Speakers x Per Unit Cost = Total _____ x _____ = _____

Totals:
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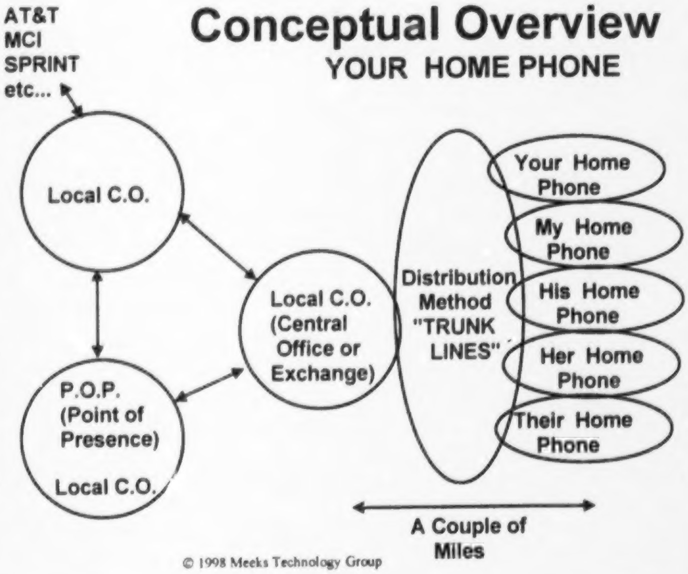
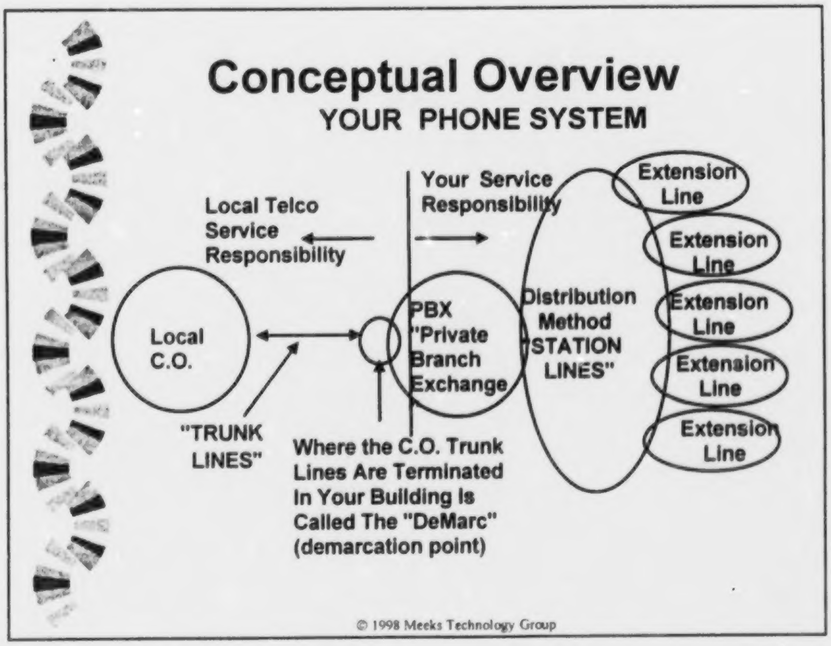
VOICE NETWORKS

Basic Concepts and
System Types

Conceptual Overview

YOUR HOME PHONE





Conceptual Overview

YOUR PHONE SYSTEM

Local Telco Service Responsibility

Your Service Responsibility

Local C.O.

"TRUNK LINES"

PBX "Private Branch Exchange

Distribution Method "STATION LINES"

Extension Line

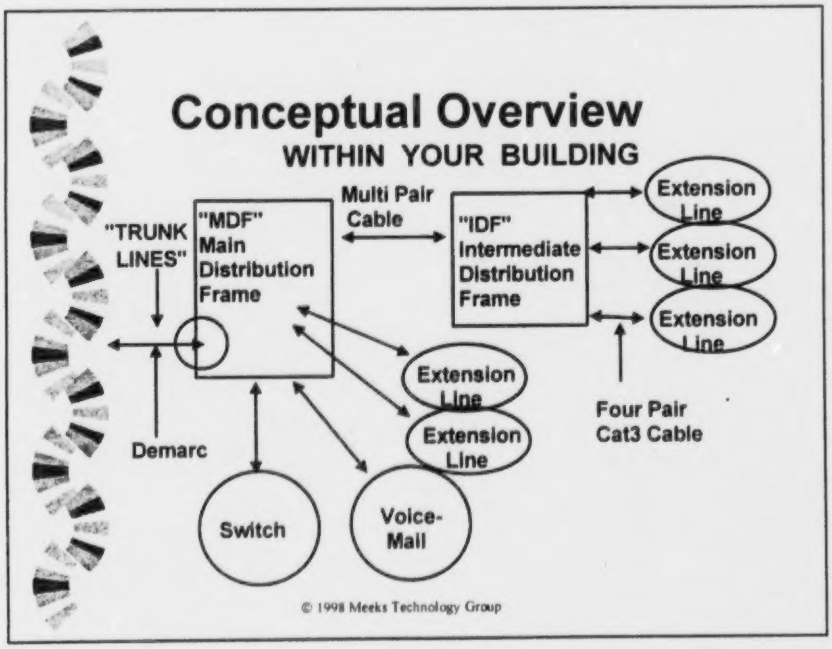
Extension Line

Extension Line

Extension Line

Extension Line

Where the C.O. Trunk Lines Are Terminated In Your Building Is Called The "DeMarc" (demarcation point)



Conceptual Overview

WITHIN YOUR BUILDING

"TRUNK LINES"

"MDF" Main Distribution Frame

Multi Pair Cable

"IDF" Intermediate Distribution Frame

Extension Line

Extension Line

Extension Line

Extension Line

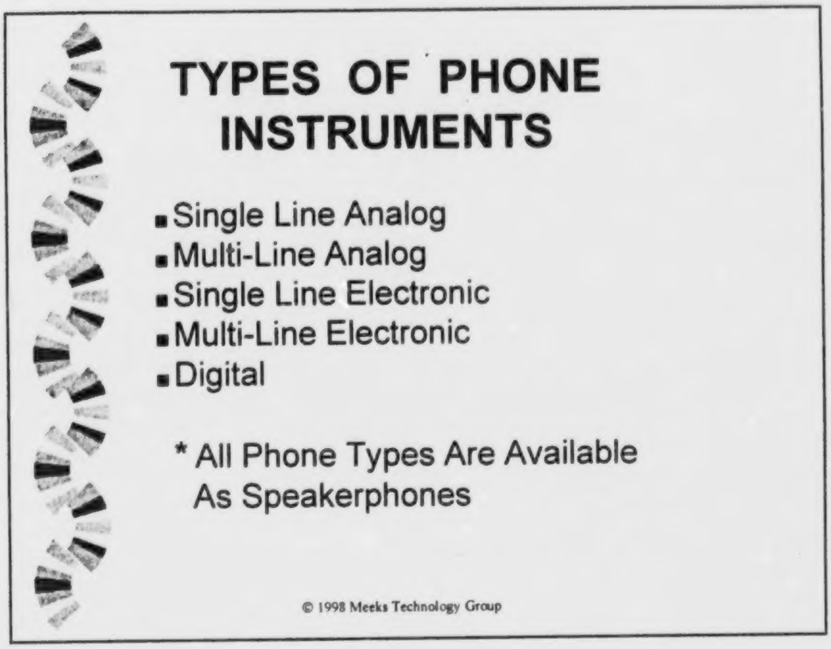
Extension Line

Demarc

Switch

Voice-Mail

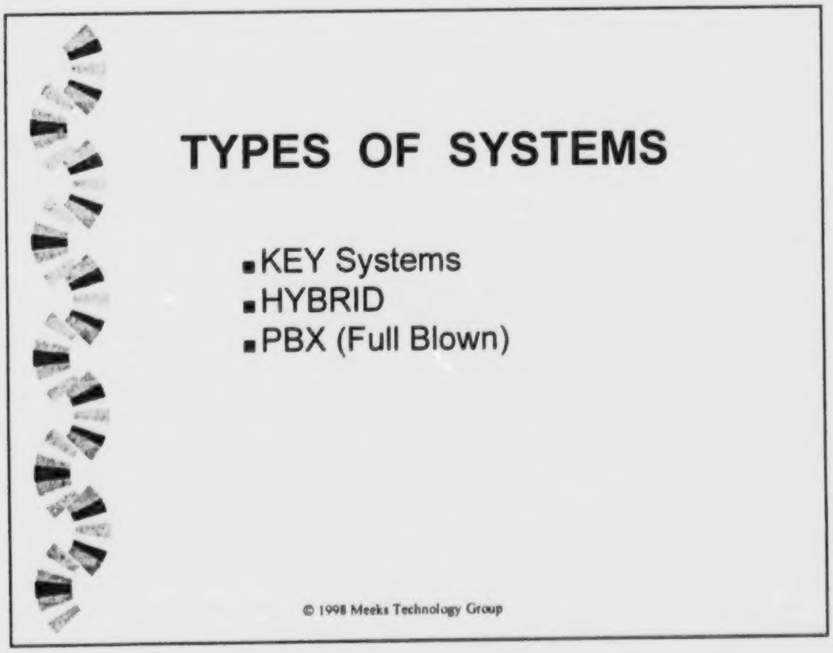
Four Pair Cat3 Cable



TYPES OF PHONE INSTRUMENTS

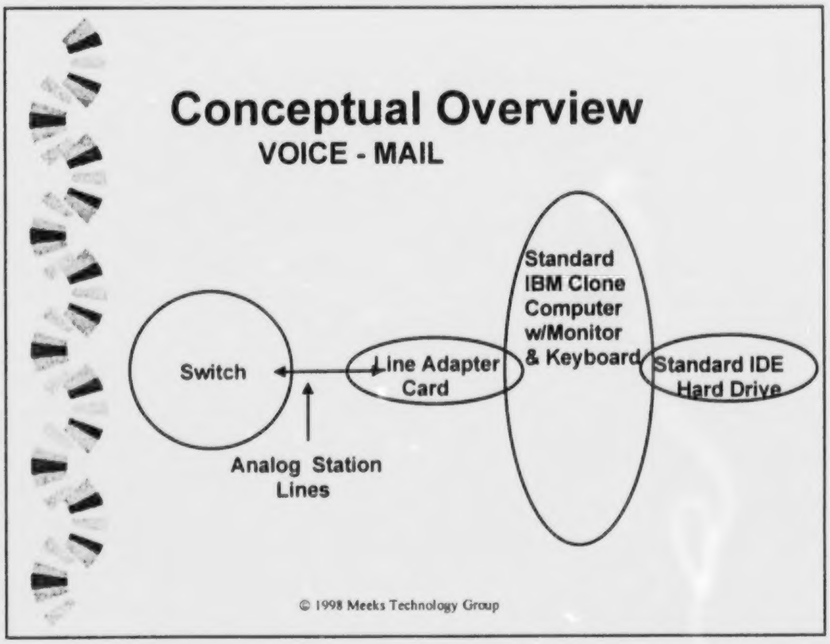
- Single Line Analog
- Multi-Line Analog
- Single Line Electronic
- Multi-Line Electronic
- Digital

* All Phone Types Are Available
As Speakerphones



TYPES OF SYSTEMS

- KEY Systems
- HYBRID
- PBX (Full Blown)



Conceptual Overview

VOICE - MAIL

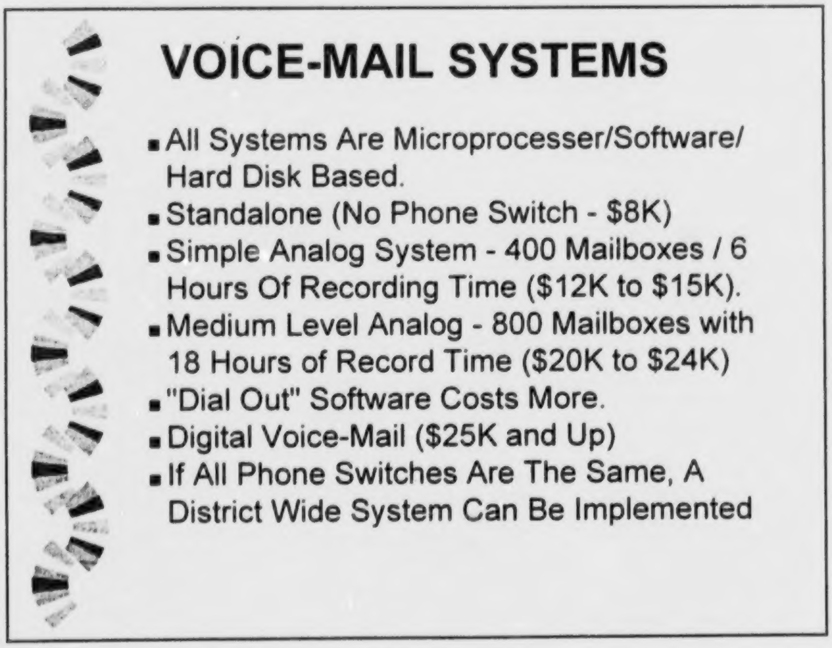
Switch

Line Adapter Card

Analog Station Lines

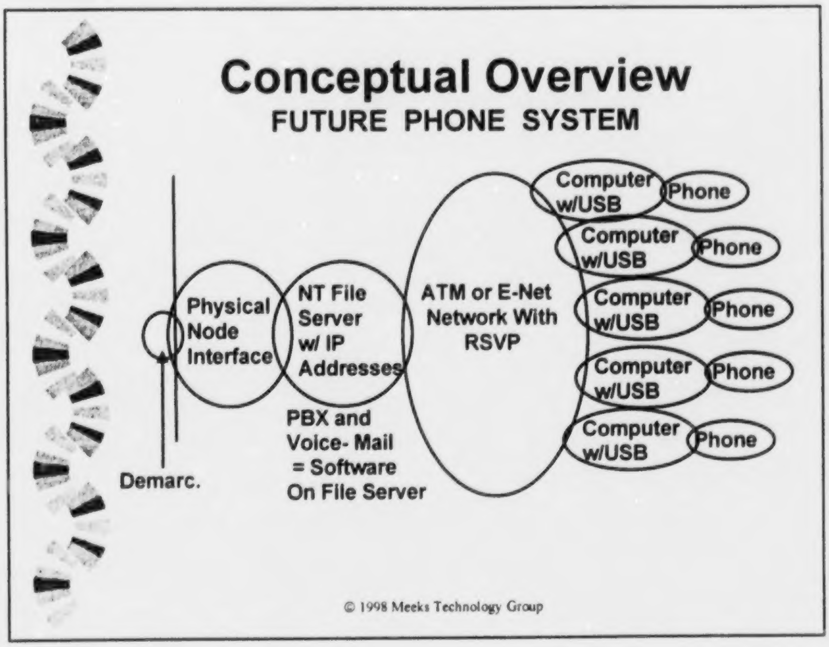
Standard IBM Clone Computer w/Monitor & Keyboard

Standard IDE Hard Drive



VOICE-MAIL SYSTEMS

- All Systems Are Microprocesser/Software/ Hard Disk Based.
- Standalone (No Phone Switch - $8K)
- Simple Analog System - 400 Mailboxes / 6 Hours Of Recording Time ($12K to $15K).
- Medium Level Analog - 800 Mailboxes with 18 Hours of Record Time ($20K to $24K)
- "Dial Out" Software Costs More.
- Digital Voice-Mail ($25K and Up)
- If All Phone Switches Are The Same, A District Wide System Can Be Implemented



Conceptual Overview

FUTURE PHONE SYSTEM

Physical Node Interface

NT File Server w/ IP Addresses

ATM or E-Net Network With RSVP

Computer w/USB — Phone

Computer w/USB — Phone

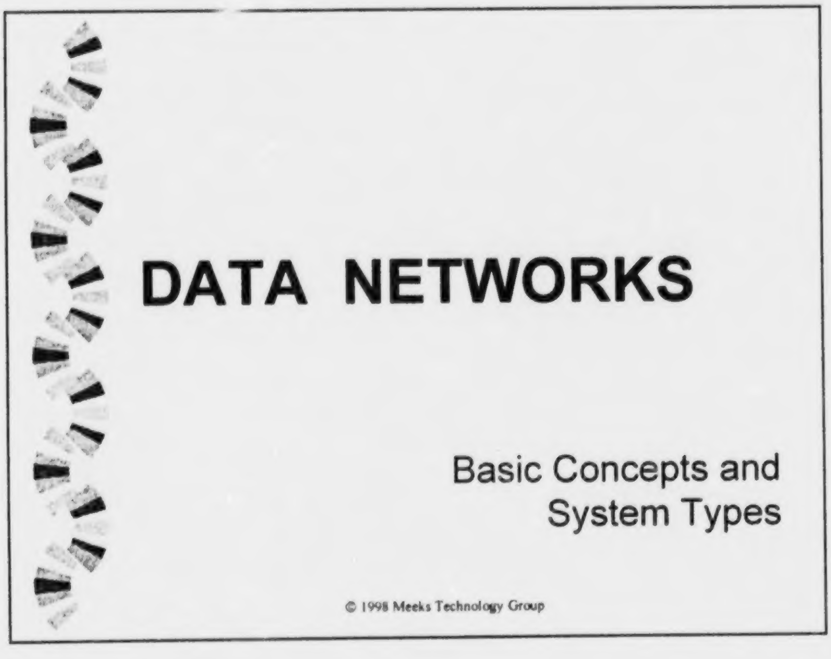
Computer w/USB — Phone

Computer w/USB — Phone

Computer w/USB — Phone

Demarc.

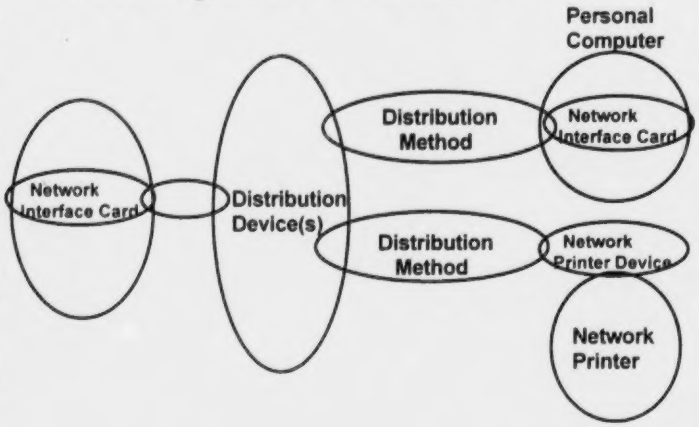
PBX and Voice- Mail = Software On File Server



DATA NETWORKS

Basic Concepts and
System Types

Conceptual Overview



Personal Computer

Network Interface Card

Distribution Method

Network Interface Card

Distribution Device(s)

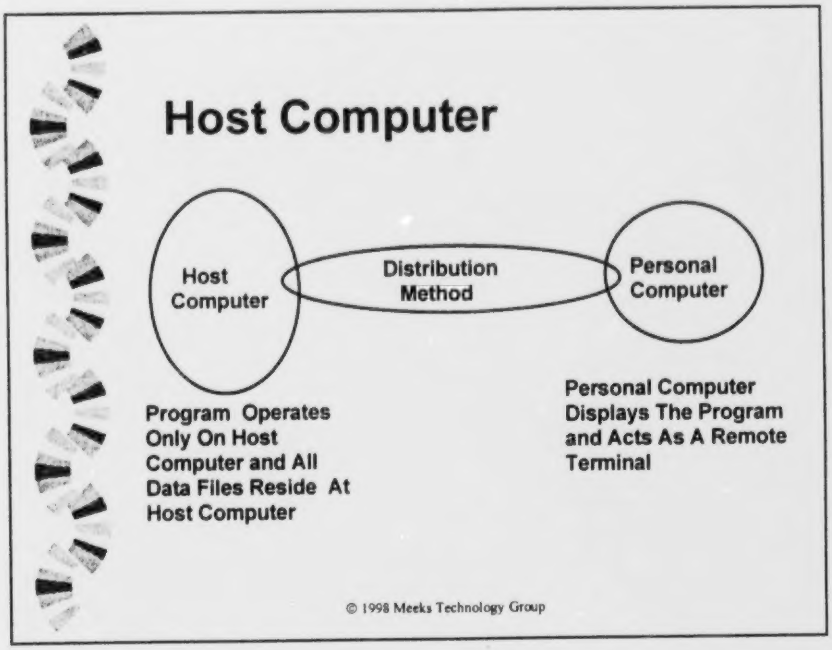
Distribution Method

Network Printer Device

Network Printer

TYPES OF DATA DISTRIBUTION MODELS

- Host Computer
- Peer-To-Peer
- Fileserver
- Client / Server
- Fat Server / Thin Client



Host Computer

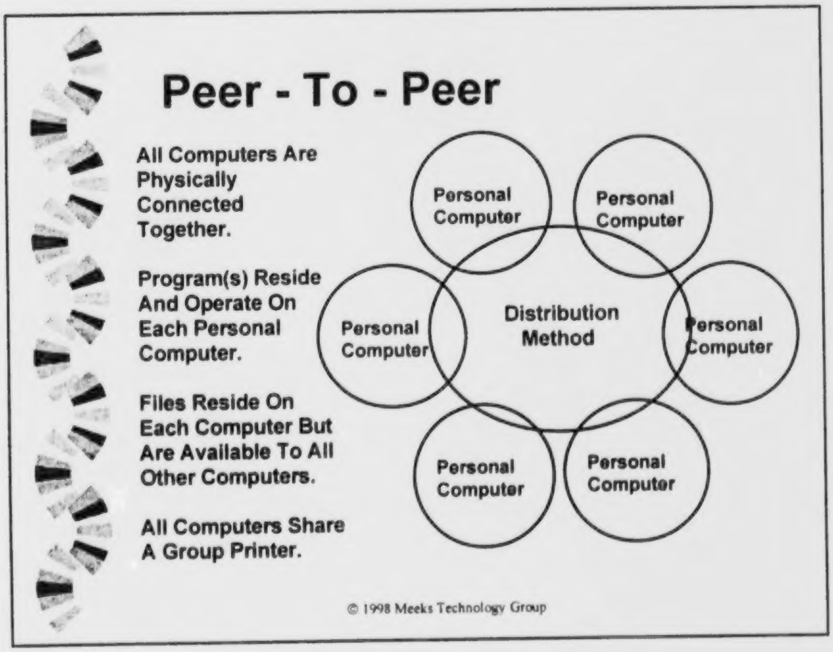
Host Computer

Distribution Method

Personal Computer

Program Operates Only On Host Computer and All Data Files Reside At Host Computer

Personal Computer Displays The Program and Acts As A Remote Terminal



Peer - To - Peer

All Computers Are Physically Connected Together.

Program(s) Reside And Operate On Each Personal Computer.

Files Reside On Each Computer But Are Available To All Other Computers.

All Computers Share A Group Printer.

Personal Computer

Personal Computer

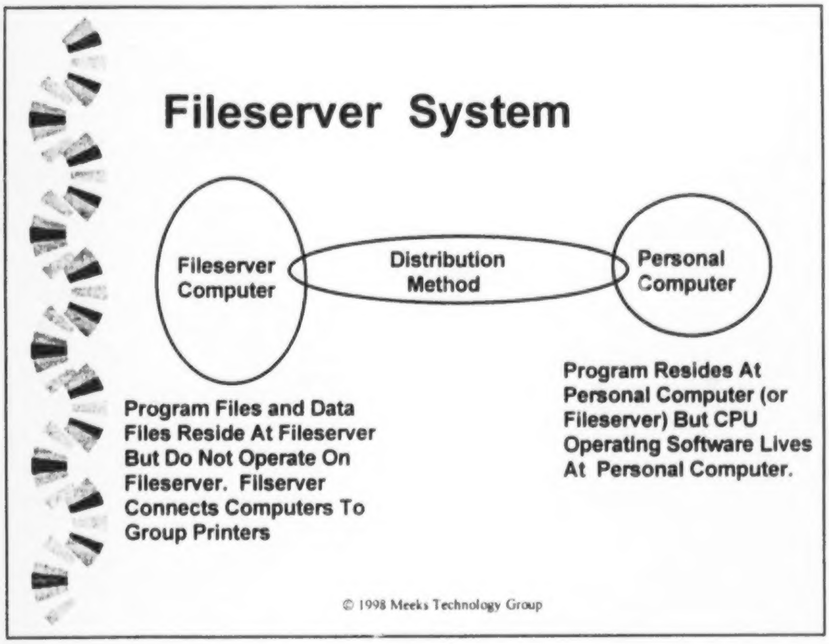
Personal Computer

Distribution Method

Personal Computer

Personal Computer

Personal Computer



Fileserver System

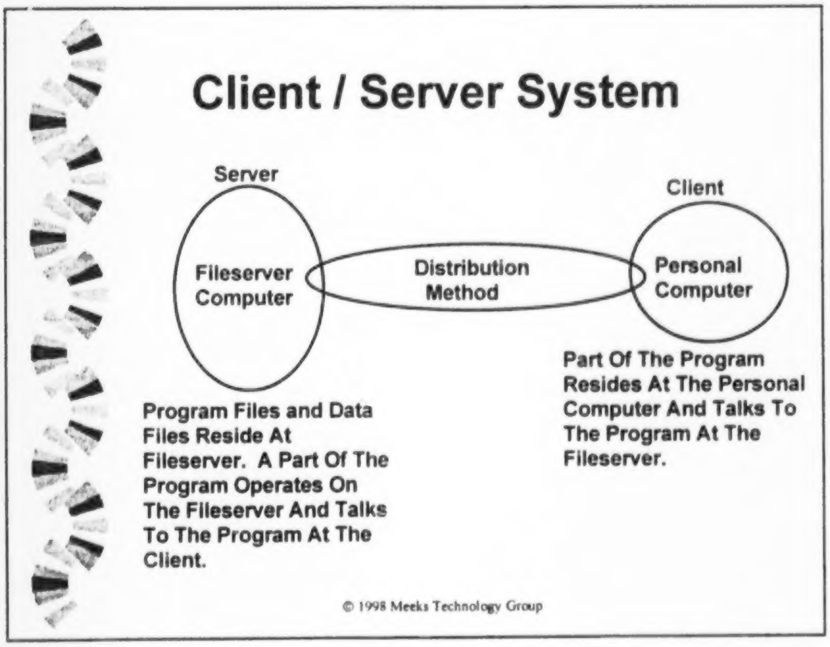
Fileserver Computer

Distribution Method

Personal Computer

Program Files and Data Files Reside At Fileserver But Do Not Operate On Fileserver. Filserver Connects Computers To Group Printers

Program Resides At Personal Computer (or Fileserver) But CPU Operating Software Lives At Personal Computer.



Client / Server System

Server

Fileserver Computer

Distribution Method

Client

Personal Computer

Program Files and Data Files Reside At Fileserver. A Part Of The Program Operates On The Fileserver And Talks To The Program At The Client.

Part Of The Program Resides At The Personal Computer And Talks To The Program At The Fileserver.

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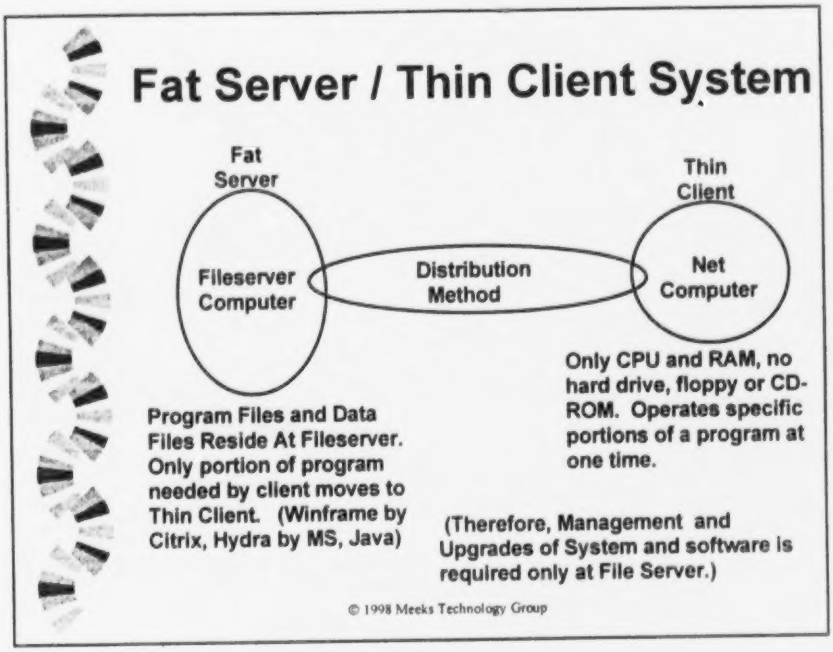


Fat Server / Thin Client System

Fat Server

Fileserver Computer

Distribution Method

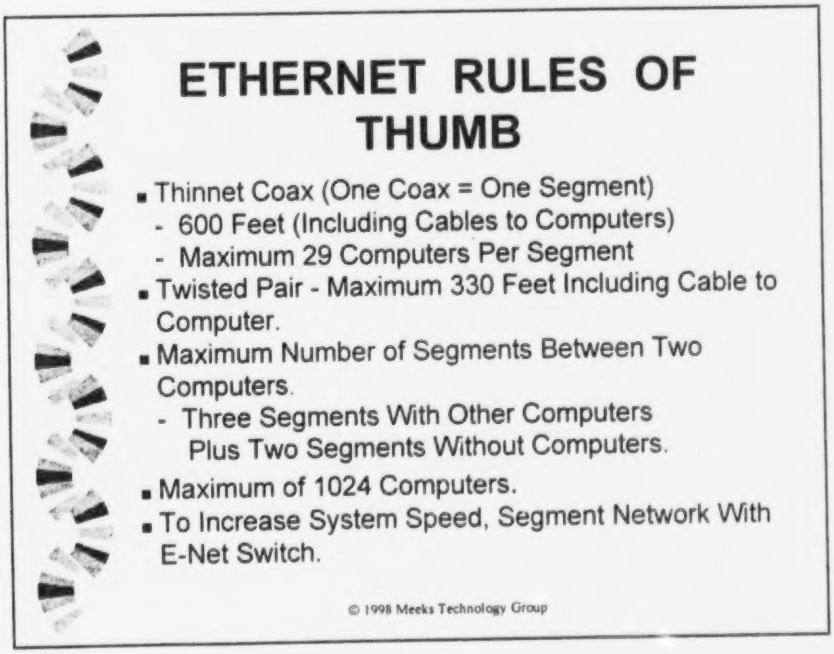
Thin Client

Net Computer

Program Files and Data Files Reside At Fileserver. Only portion of program needed by client moves to Thin Client. (Winframe by Citrix, Hydra by MS, Java)

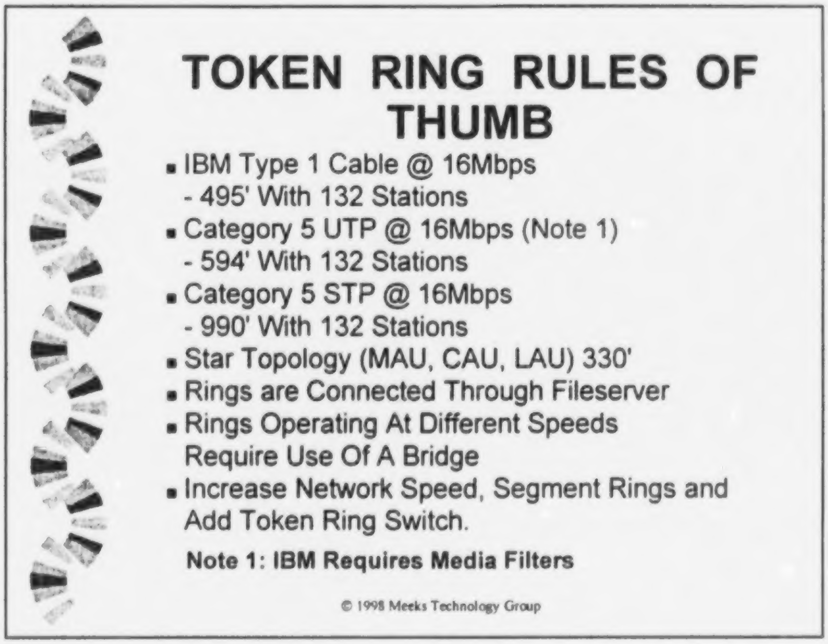
Only CPU and RAM, no hard drive, floppy or CD-ROM. Operates specific portions of a program at one time.

(Therefore, Management and Upgrades of System and software is required only at File Server.)



ETHERNET RULES OF THUMB

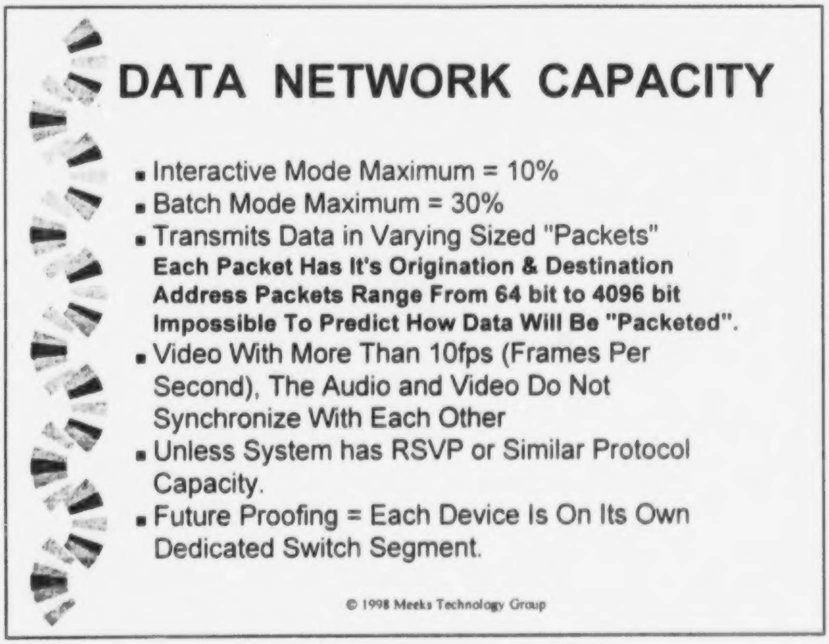
- Thinnet Coax (One Coax = One Segment)
  - 600 Feet (Including Cables to Computers)
  - Maximum 29 Computers Per Segment
- Twisted Pair - Maximum 330 Feet Including Cable to Computer.
- Maximum Number of Segments Between Two Computers.
  - Three Segments With Other Computers Plus Two Segments Without Computers.
- Maximum of 1024 Computers.
- To Increase System Speed, Segment Network With E-Net Switch.



TOKEN RING RULES OF THUMB

- IBM Type 1 Cable @ 16Mbps
  - 495' With 132 Stations
- Category 5 UTP @ 16Mbps (Note 1)
  - 594' With 132 Stations
- Category 5 STP @ 16Mbps
  - 990' With 132 Stations
- Star Topology (MAU, CAU, LAU) 330'
- Rings are Connected Through Fileserver
- Rings Operating At Different Speeds Require Use Of A Bridge
- Increase Network Speed, Segment Rings and Add Token Ring Switch.

Note 1: IBM Requires Media Filters



DATA NETWORK CAPACITY

- Interactive Mode Maximum = 10%
- Batch Mode Maximum = 30%
- Transmits Data in Varying Sized "Packets"
  Each Packet Has It's Origination & Destination Address Packets Range From 64 bit to 4096 bit Impossible To Predict How Data Will Be "Packeted".
- Video With More Than 10fps (Frames Per Second), The Audio and Video Do Not Synchronize With Each Other
- Unless System has RSVP or Similar Protocol Capacity.
- Future Proofing = Each Device Is On Its Own Dedicated Switch Segment.

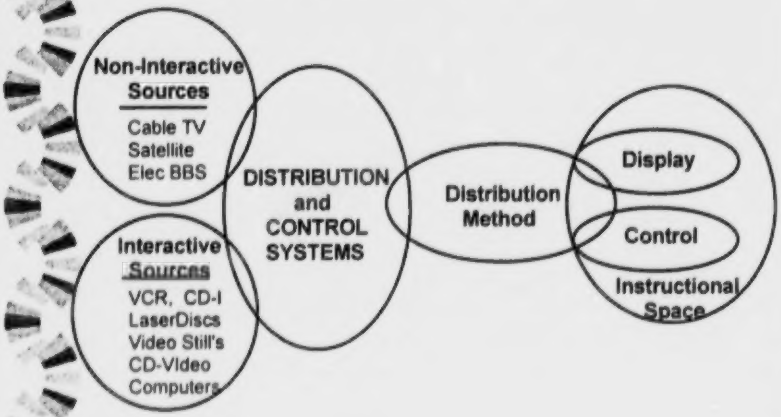
Switched or Shared Ethernet Or Token Ring Networks Cannot Transmit "Full Motion" - "Full Screen" Video Without Special Equipment AND Limiting The Number of Users OR Use of RSVP Protocol.

However, "ATM" Networks (Asynchronous Transmission Method) Does Not Exhibit These Limitations But Are VERY EXPENSIVE

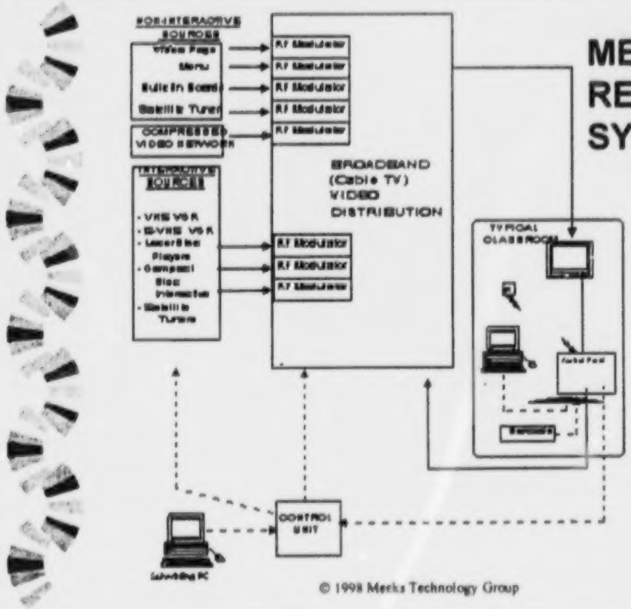
MEDIA RETRIEVAL SYSTEMS

Basic Concepts and System Types

Conceptual Overview



MEDIA RETRIEVAL SYSTEM



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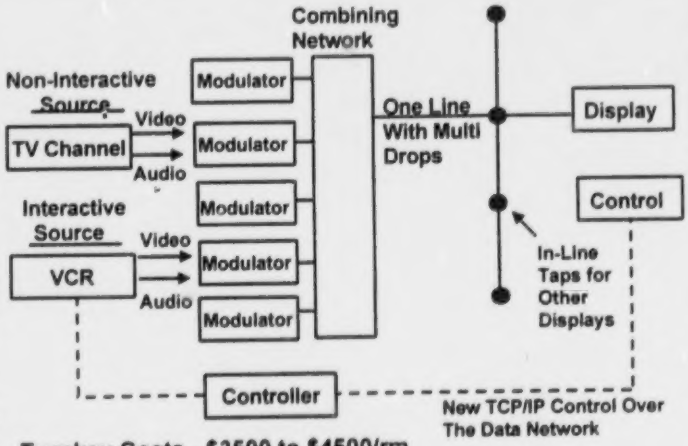
BEST COPY AVAILABLE

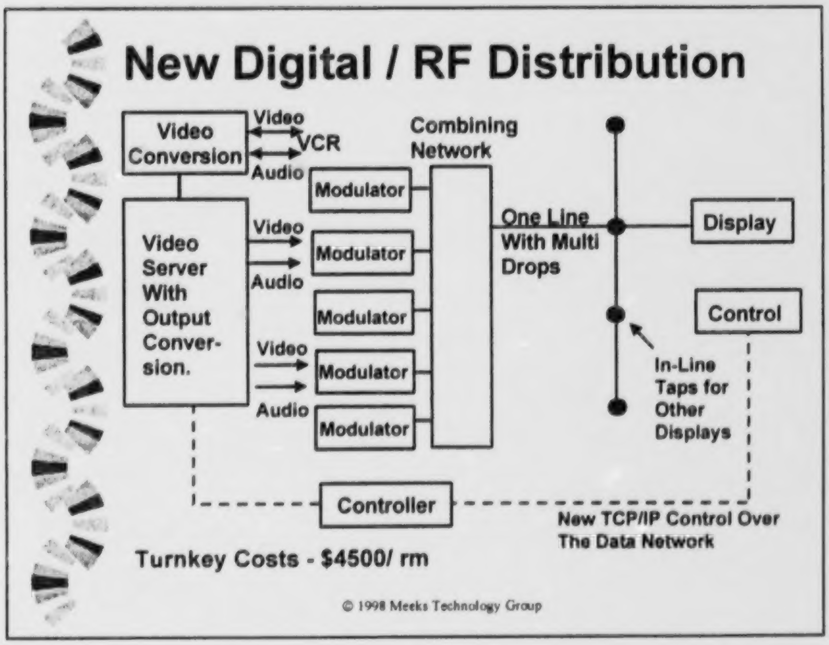
TYPES OF SYSTEMS

- Cable TV
  (Also called RF "Radio Frequency " System or Broadband System)
- Shielded Twisted Pair
- Baseband Coax (Baseband Copper)
- Baseband Fiber
- Digital Source / RF Distribution
- Total Digital

Cable TV (RF or Broadband)



Turnkey Costs - $3500 to $4500/rm



New Digital / RF Distribution

Video Conversion

Video

VCR

Audio

Video Server With Output Conversion.

Video

Audio

Video

Audio

Modulator

Modulator

Modulator

Modulator

Modulator

Combining Network

One Line With Multi Drops

Display

Control

In-Line Taps for Other Displays

Controller

New TCP/IP Control Over The Data Network

Turnkey Costs - $4500/ rm

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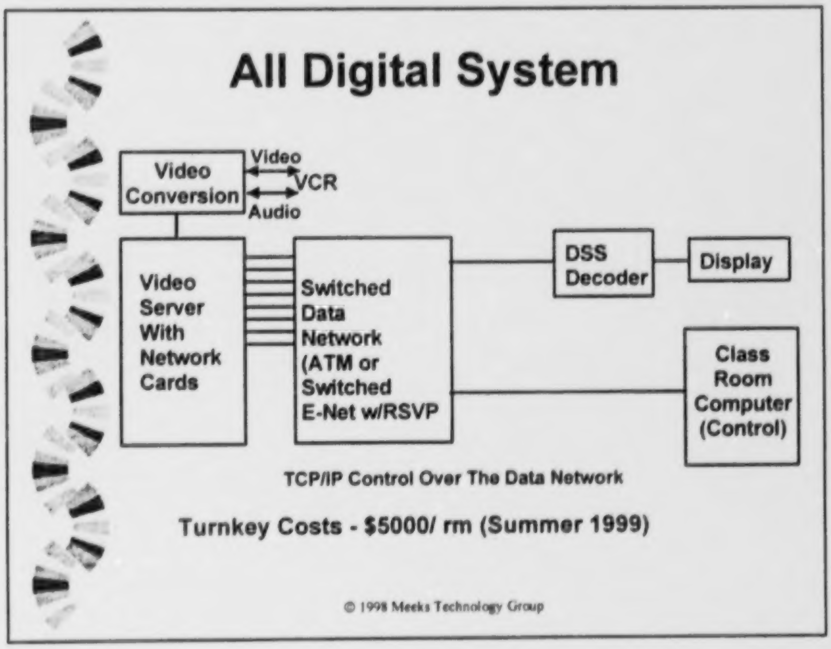

All Digital System

Video Conversion

Video

VCR

Audio

Video Server With Network Cards

Switched Data Network (ATM or Switched E-Net w/RSVP

DSS Decoder

Display

Class Room Computer (Control)

TCP/IP Control Over The Data Network

Turnkey Costs - $5000/ rm (Summer 1999)

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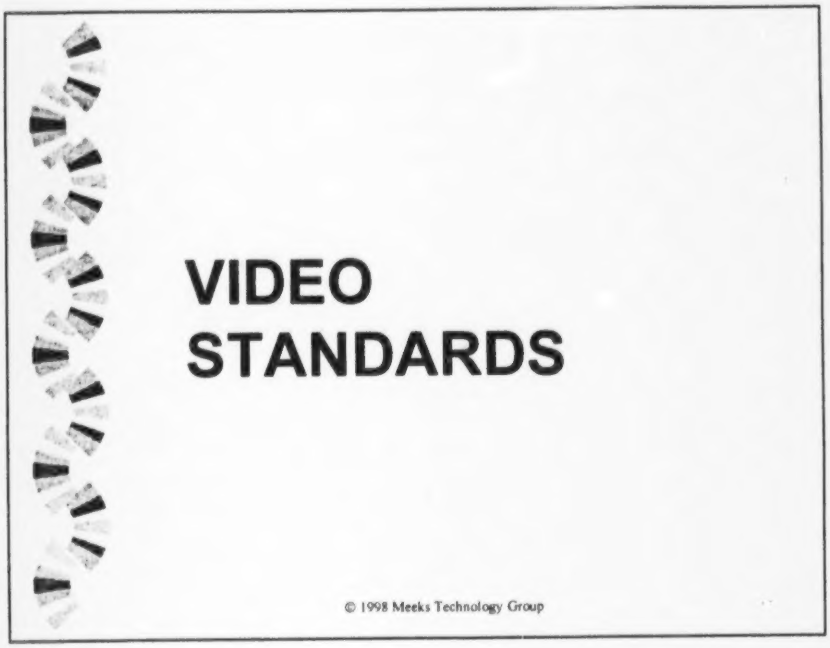
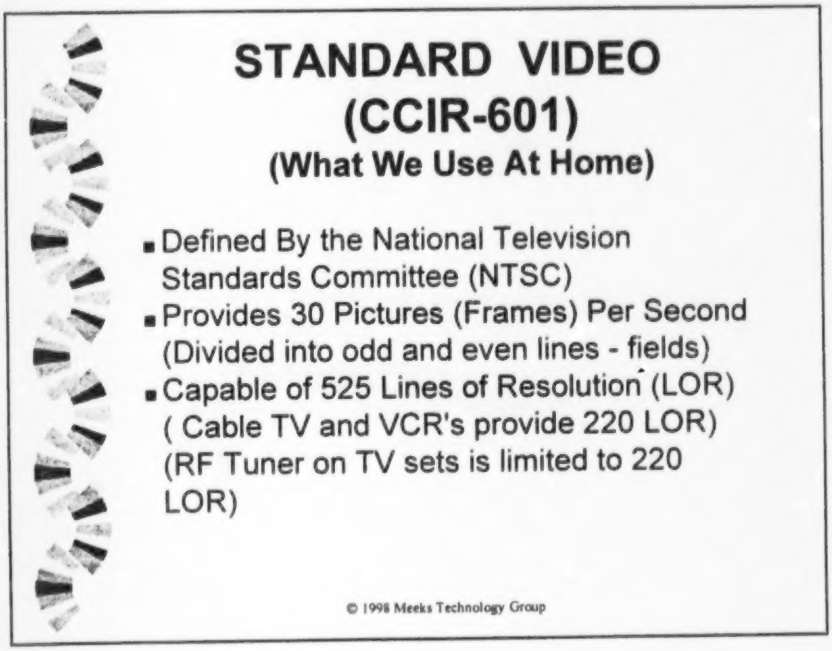


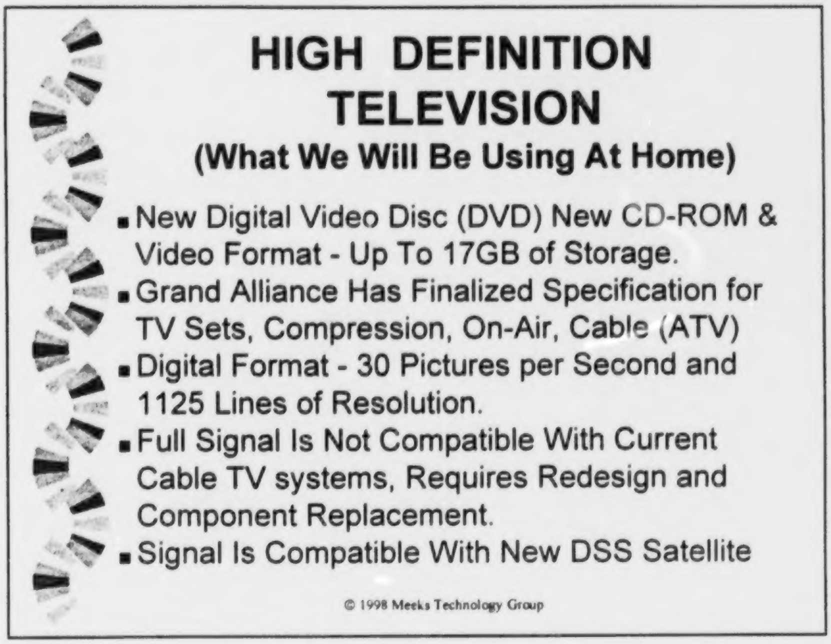
VIDEO STANDARDS



STANDARD VIDEO (CCIR-601)

(What We Use At Home)

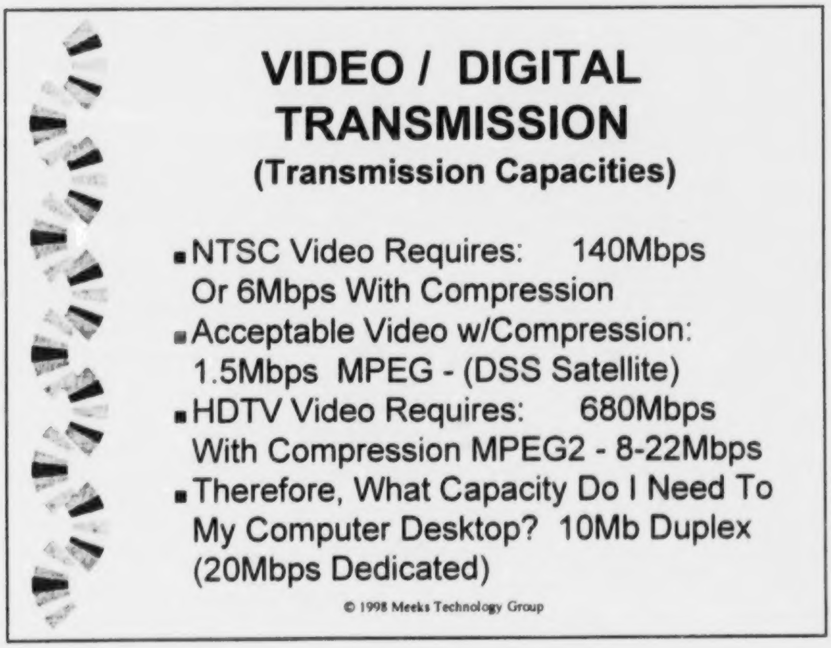
- Defined By the National Television Standards Committee (NTSC)
- Provides 30 Pictures (Frames) Per Second (Divided into odd and even lines - fields)
- Capable of 525 Lines of Resolution (LOR) (Cable TV and VCR's provide 220 LOR) (RF Tuner on TV sets is limited to 220 LOR)



HIGH DEFINITION TELEVISION

(What We Will Be Using At Home)

- New Digital Video Disc (DVD) New CD-ROM & Video Format - Up To 17GB of Storage.
- Grand Alliance Has Finalized Specification for TV Sets, Compression, On-Air, Cable (ATV)
- Digital Format - 30 Pictures per Second and 1125 Lines of Resolution.
- Full Signal Is Not Compatible With Current Cable TV systems, Requires Redesign and Component Replacement.
- Signal Is Compatible With New DSS Satellite



VIDEO / DIGITAL TRANSMISSION

(Transmission Capacities)

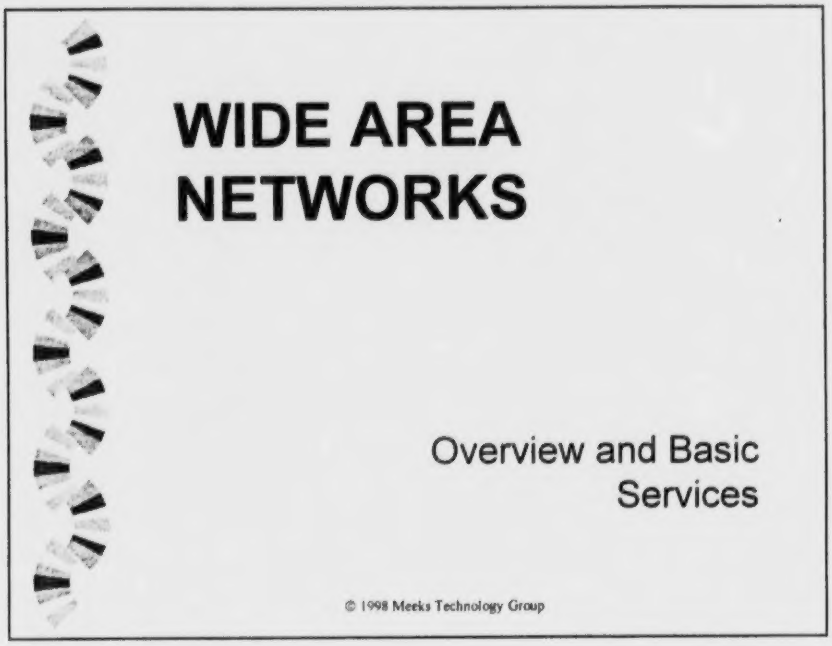
- NTSC Video Requires: 140Mbps Or 6Mbps With Compression
- Acceptable Video w/Compression: 1.5Mbps MPEG - (DSS Satellite)
- HDTV Video Requires: 680Mbps With Compression MPEG2 - 8-22Mbps
- Therefore, What Capacity Do I Need To My Computer Desktop? 10Mb Duplex (20Mbps Dedicated)

SCREEN SIZE ISSUES

- NTSC Is "4Wide by 3 High" - Typical of The Box This Text Appears In.
- HDTV Will Change ScreenRatios To "16 Wide by 9High"A Ratio Similar To Movie Theater Screens.
- "Quicktime" Is 1/8 to 1/4 NTSC Screen Size And At Fewer Frames Per Second.

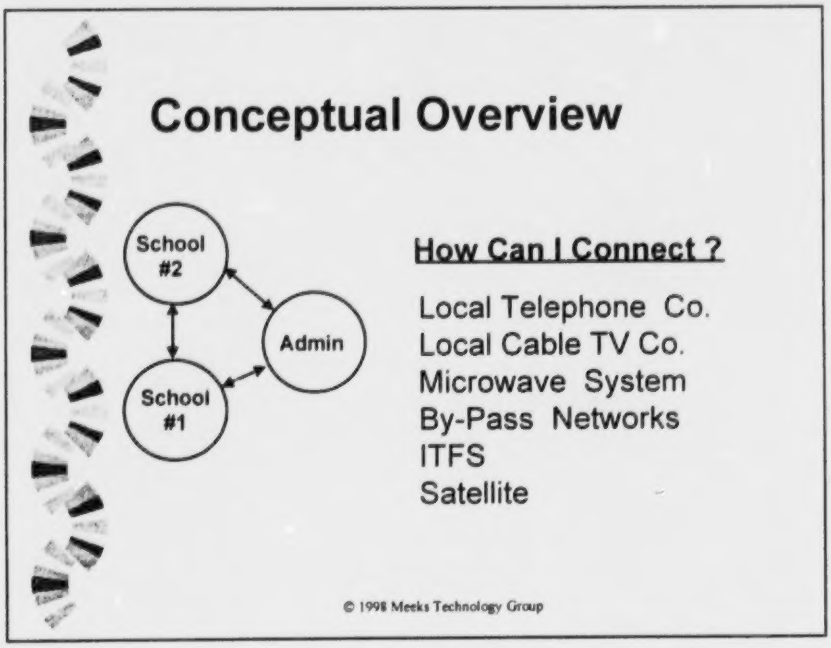
VIEWING DISTANCE STANDARDS

- Standard Television
  1" of Diagonal = 1' of Viewing Distance
- Projection Screens (Film & Video)
  Screen Width = 1/6 of Max Viewing Distance
- Computer (Similar Resolution to Film)
  Screen = 1/6 of Max Viewing Distance



WIDE AREA NETWORKS

Overview and Basic Services

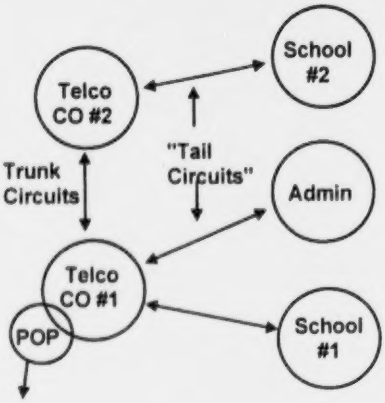


Conceptual Overview

How Can I Connect ?

Local Telephone Co.
Local Cable TV Co.
Microwave System
By-Pass Networks
ITFS
Satellite

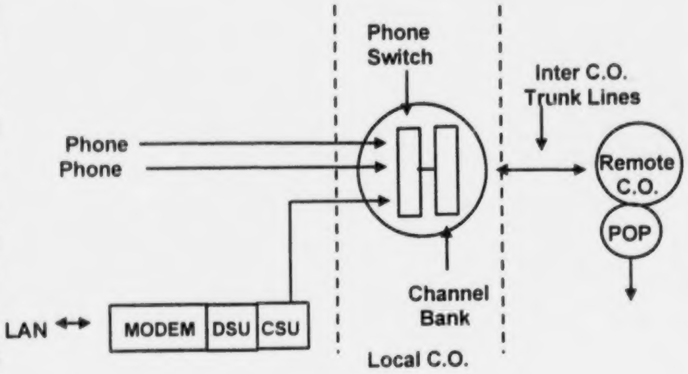
Local Telephone Company



Services

Video
Voice
Data

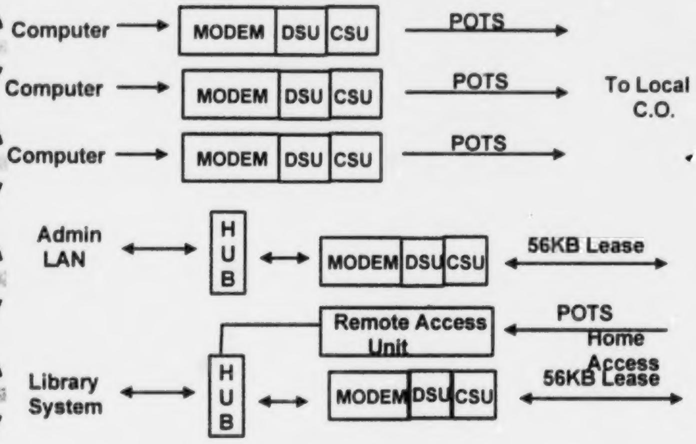
Telco - Inter C.O. & Long Distance



LOCAL TELCO SERVICES

- DEDICATED CIRCUITS:
  - 56KB Leased Lines
  - T-1 Leased Lines (1.54Mbps)
  - Frame Relay (56KBps - 2Mbps)
  - Other Dedicated Tail Circuits (1.54 to 800Mbps)
- SWITCHED CIRCUITS
  - POTS (Plain Old Telephone Service) 28Kbps
  - ISDN (Integrated Services Digital Network) Basic Rate (128Kbps), Primary Rate (1.54Mbps)
  - ATM (Asynchronous Transfer Mode) 155Mbps

Traditional School Connection



Computer → MODEM DSU CSU → POTS →

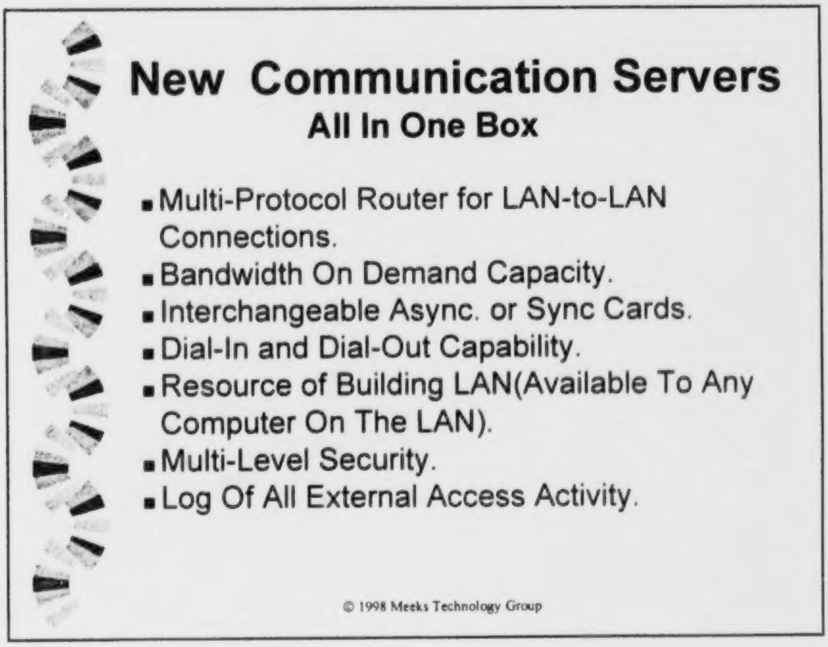
Computer → MODEM DSU CSU → POTS → To Local C.O.

Computer → MODEM DSU CSU → POTS →

Admin LAN ↔ HUB ↔ MODEM DSU CSU ↔ 56KB Lease

Remote Access Unit ← POTS Home Access

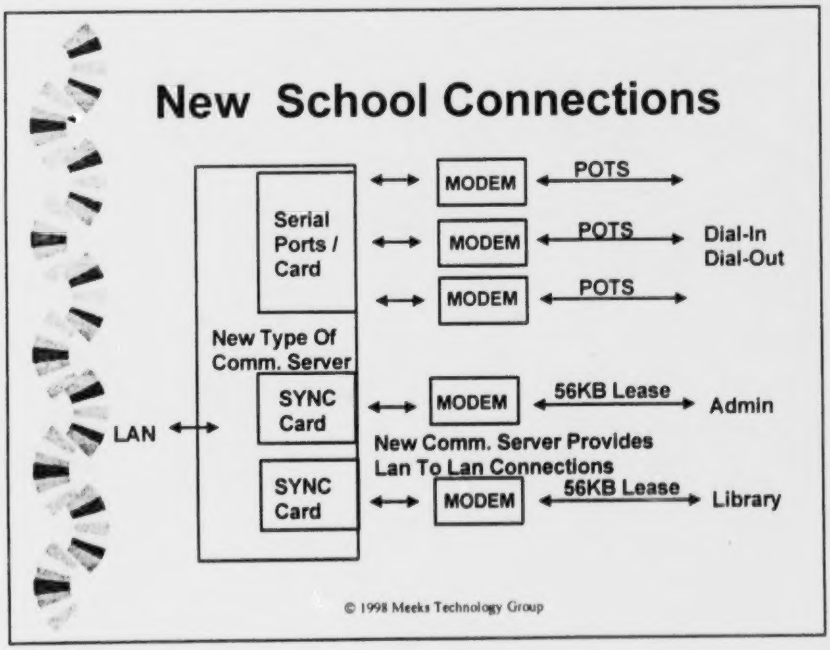
Library System ↔ HUB ↔ MODEM DSU CSU ↔ 56KB Lease



New Communication Servers

All In One Box

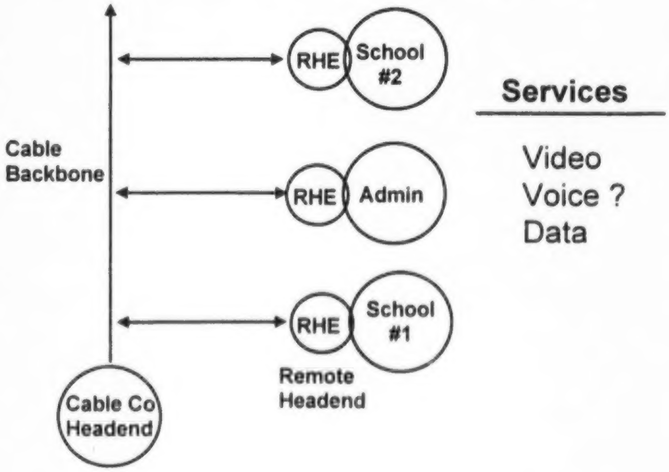
- Multi-Protocol Router for LAN-to-LAN Connections.
- Bandwidth On Demand Capacity.
- Interchangeable Async. or Sync Cards.
- Dial-In and Dial-Out Capability.
- Resource of Building LAN(Available To Any Computer On The LAN).
- Multi-Level Security.
- Log Of All External Access Activity.



New School Connections

New Comm. Server Provides Lan To Lan Connections

Local Cable TV Company



Cable Backbone

RHE School #2

RHE Admin

RHE School #1

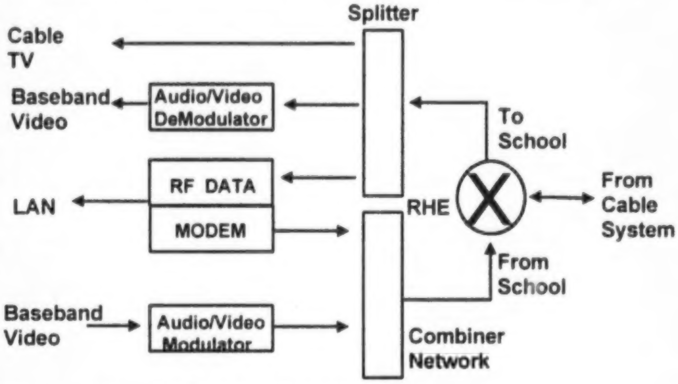
Remote Headend

Cable Co Headend

Services

Video
Voice ?
Data

Typical Cable TV Connection



Splitter

Cable TV

Baseband Video

Audio/Video DeModulator

RF DATA

MODEM

LAN

Baseband Video

Audio/Video Modulator

To School

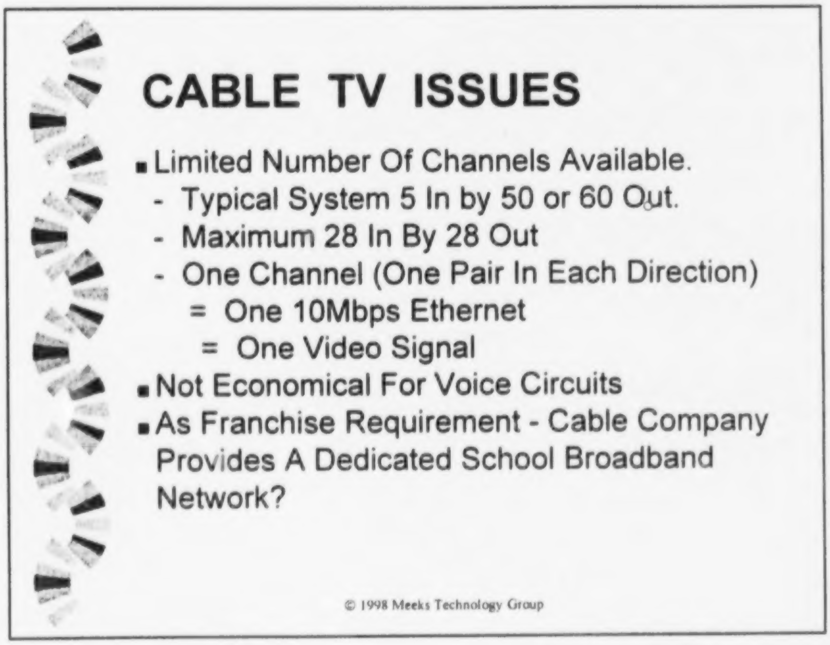
RHE

From Cable System

From School

Combiner Network

These Are "BROADBAND" Systems



CABLE TV ISSUES

- Limited Number Of Channels Available.
  - Typical System 5 In by 50 or 60 Out.
  - Maximum 28 In By 28 Out
  - One Channel (One Pair In Each Direction)
    - = One 10Mbps Ethernet
    - = One Video Signal
- Not Economical For Voice Circuits
- As Franchise Requirement - Cable Company Provides A Dedicated School Broadband Network?

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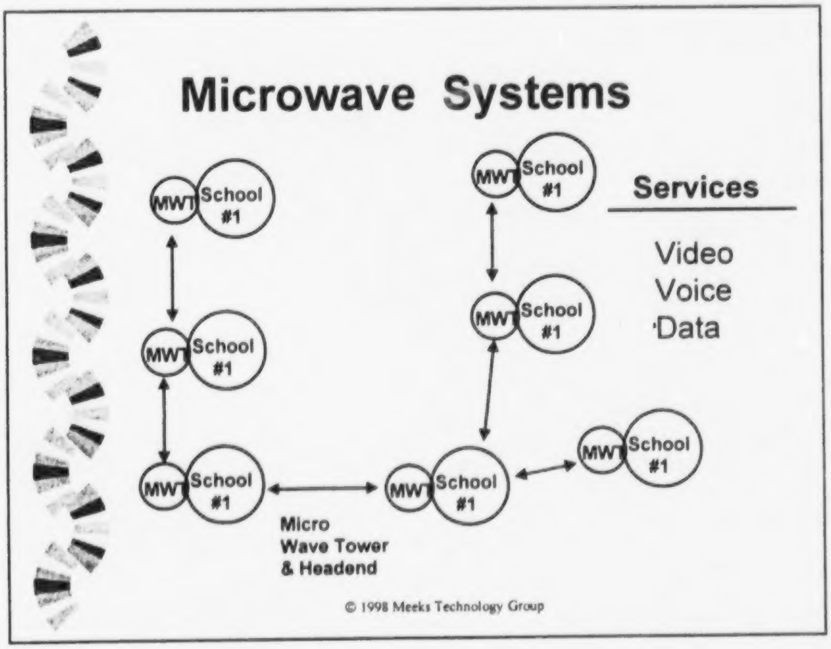

Microwave Systems

Services

Video
Voice
Data

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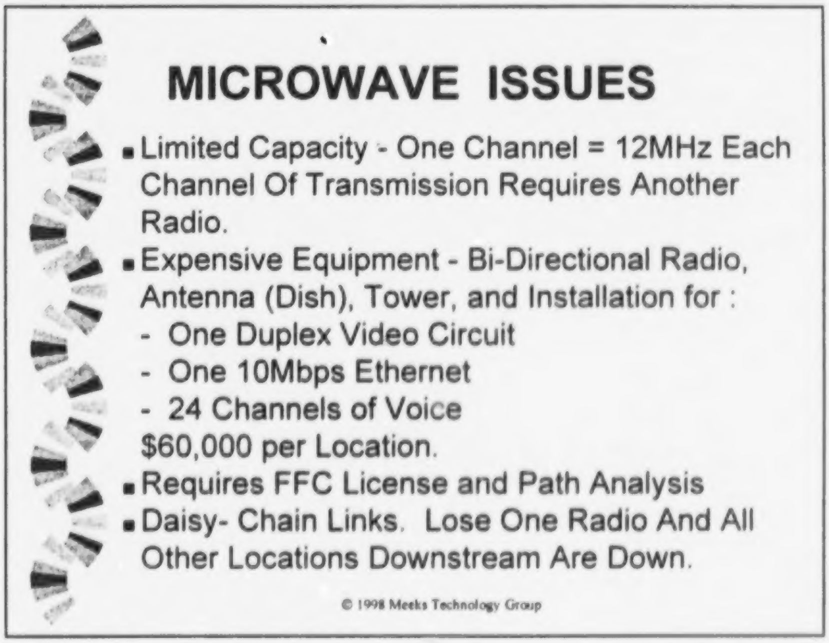
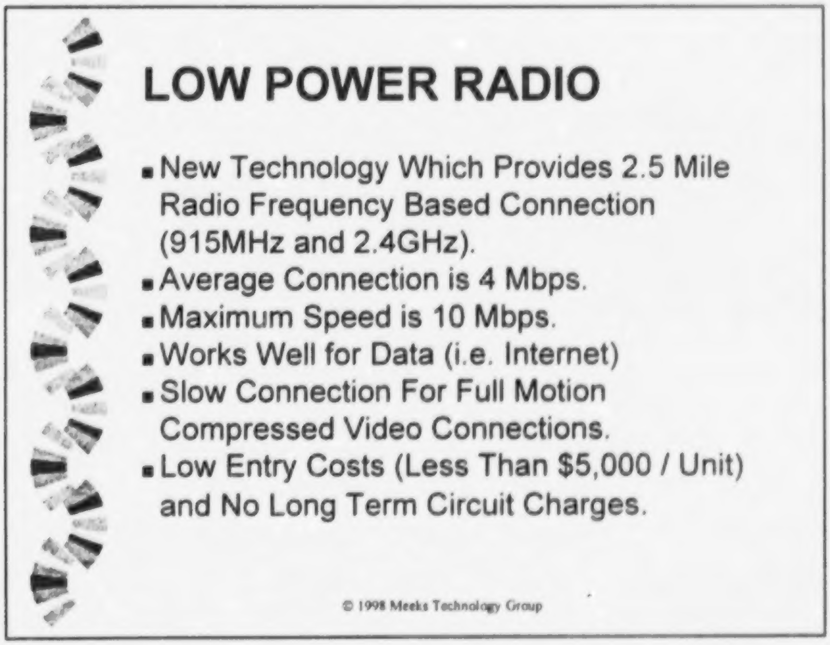


MICROWAVE ISSUES

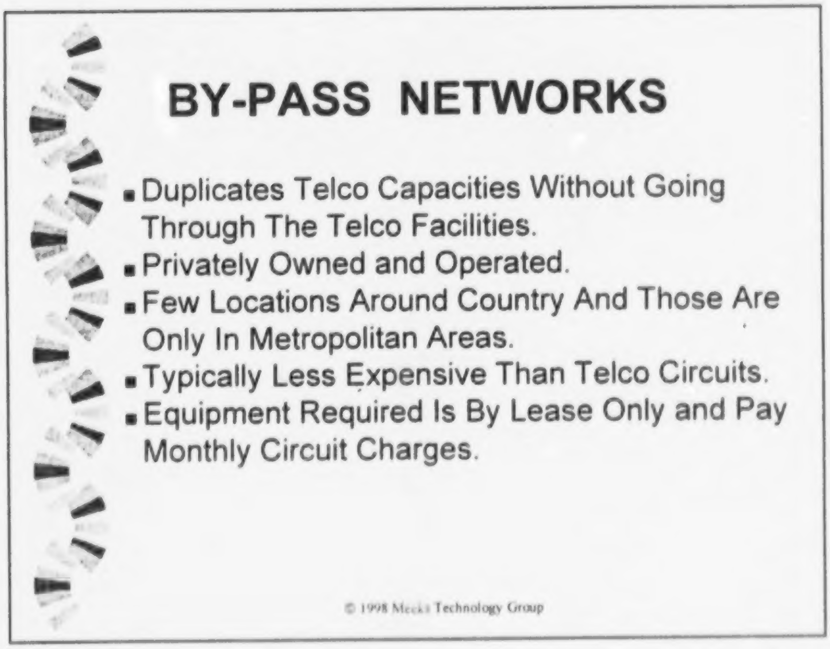
- Limited Capacity - One Channel = 12MHz Each Channel Of Transmission Requires Another Radio.
- Expensive Equipment - Bi-Directional Radio, Antenna (Dish), Tower, and Installation for :
  - One Duplex Video Circuit
  - One 10Mbps Ethernet
  - 24 Channels of Voice

  $60,000 per Location.
- Requires FFC License and Path Analysis
- Daisy- Chain Links. Lose One Radio And All Other Locations Downstream Are Down.



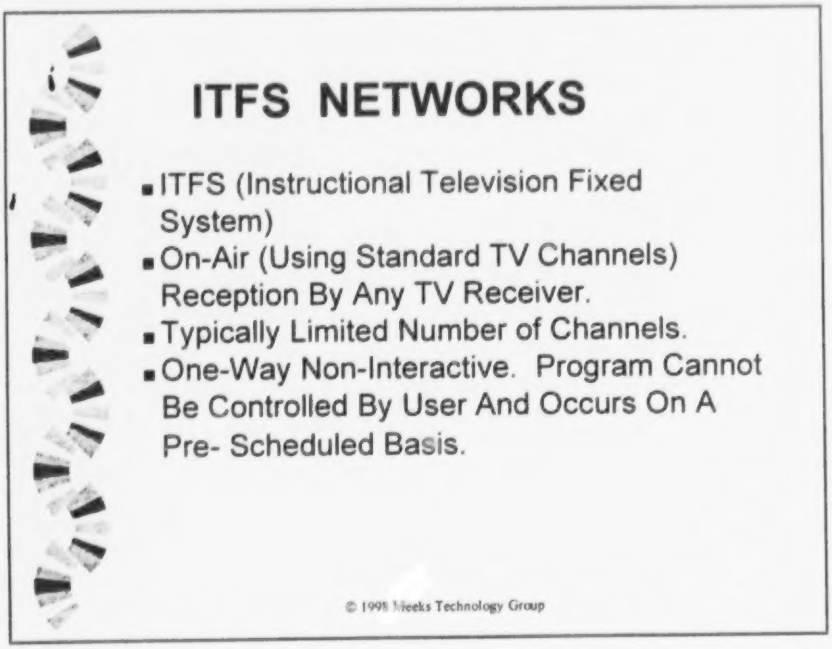
LOW POWER RADIO

- New Technology Which Provides 2.5 Mile Radio Frequency Based Connection (915MHz and 2.4GHz).
- Average Connection is 4 Mbps.
- Maximum Speed is 10 Mbps.
- Works Well for Data (i.e. Internet)
- Slow Connection For Full Motion Compressed Video Connections.
- Low Entry Costs (Less Than $5,000 / Unit) and No Long Term Circuit Charges.



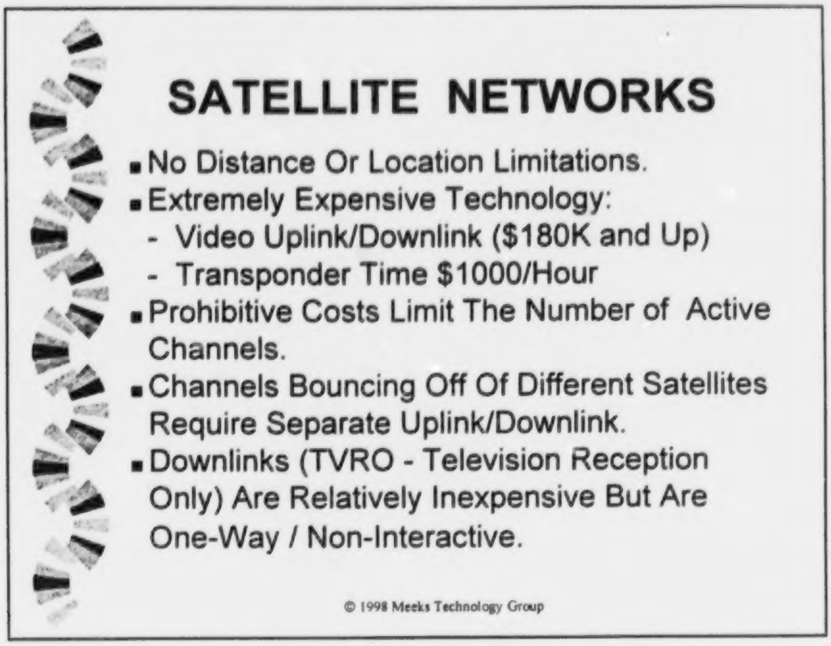
BY-PASS NETWORKS

- Duplicates Telco Capacities Without Going Through The Telco Facilities.
- Privately Owned and Operated.
- Few Locations Around Country And Those Are Only In Metropolitan Areas.
- Typically Less Expensive Than Telco Circuits.
- Equipment Required Is By Lease Only and Pay Monthly Circuit Charges.



ITFS NETWORKS

- ITFS (Instructional Television Fixed System)
- On-Air (Using Standard TV Channels) Reception By Any TV Receiver.
- Typically Limited Number of Channels.
- One-Way Non-Interactive. Program Cannot Be Controlled By User And Occurs On A Pre- Scheduled Basis.



SATELLITE NETWORKS

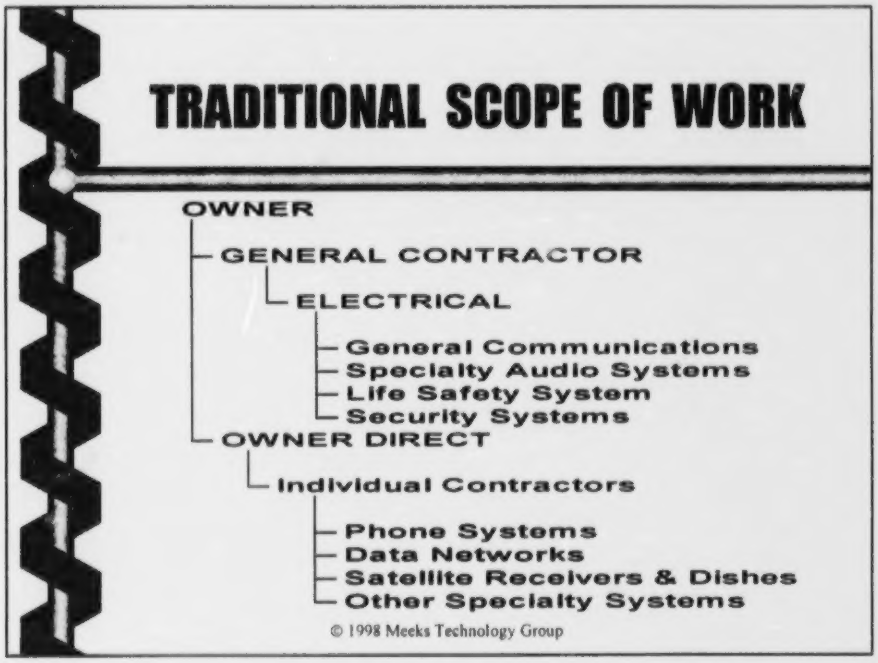
- No Distance Or Location Limitations.
- Extremely Expensive Technology:
  - Video Uplink/Downlink ($180K and Up)
  - Transponder Time $1000/Hour
- Prohibitive Costs Limit The Number of Active Channels.
- Channels Bouncing Off Of Different Satellites Require Separate Uplink/Downlink.
- Downlinks (TVRO - Television Reception Only) Are Relatively Inexpensive But Are One-Way / Non-Interactive.

TECHNOLOGY BID PACKAGES

Controlling The Process

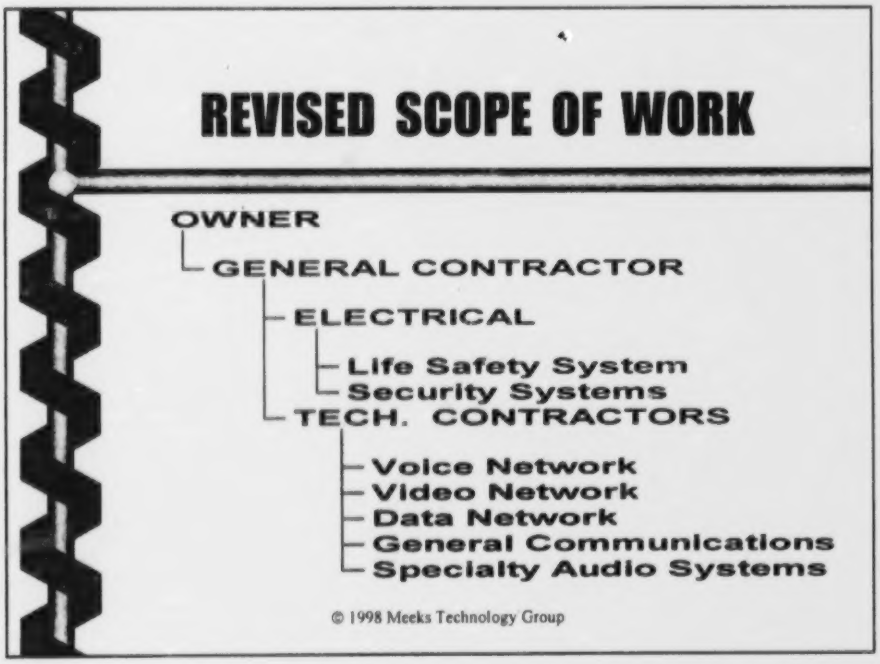
TECHNOLOGY and BID ISSUES (Changes)

- Division of Work
- Project Timelines
- Actual Bid Process



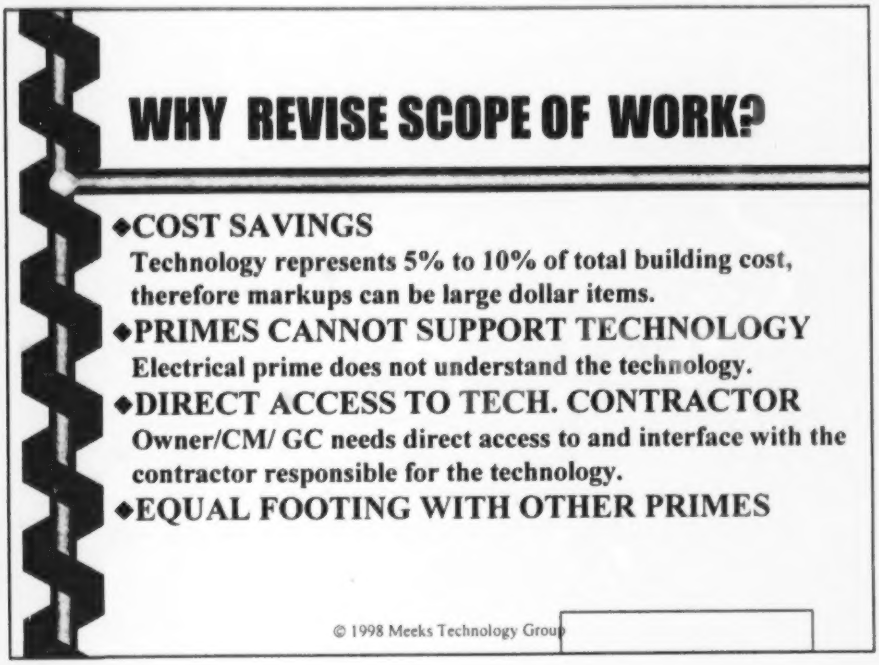
TRADITIONAL SCOPE OF WORK

- OWNER
  - GENERAL CONTRACTOR
    - ELECTRICAL
      - General Communications
      - Specialty Audio Systems
      - Life Safety System
      - Security Systems
  - OWNER DIRECT
    - Individual Contractors
      - Phone Systems
      - Data Networks
      - Satellite Receivers & Dishes
      - Other Specialty Systems



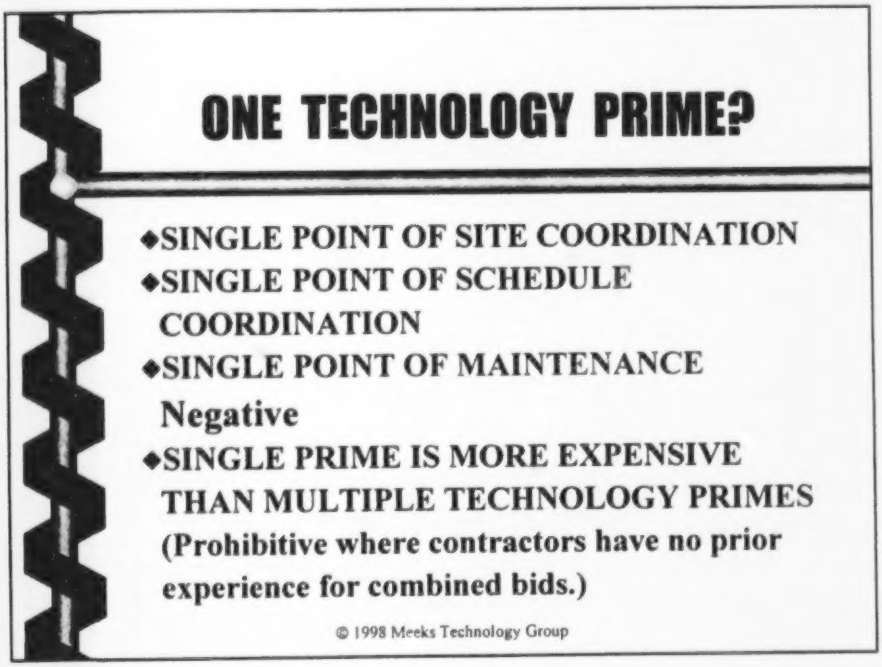
REVISED SCOPE OF WORK

- OWNER
  - GENERAL CONTRACTOR
    - ELECTRICAL
      - Life Safety System
      - Security Systems
    - TECH. CONTRACTORS
      - Voice Network
      - Video Network
      - Data Network
      - General Communications
      - Specialty Audio Systems



WHY REVISE SCOPE OF WORK?

- ◆COST SAVINGS
  Technology represents 5% to 10% of total building cost, therefore markups can be large dollar items.
- ◆PRIMES CANNOT SUPPORT TECHNOLOGY
  Electrical prime does not understand the technology.
- ◆DIRECT ACCESS TO TECH. CONTRACTOR
  Owner/CM/ GC needs direct access to and interface with the contractor responsible for the technology.
- ◆EQUAL FOOTING WITH OTHER PRIMES

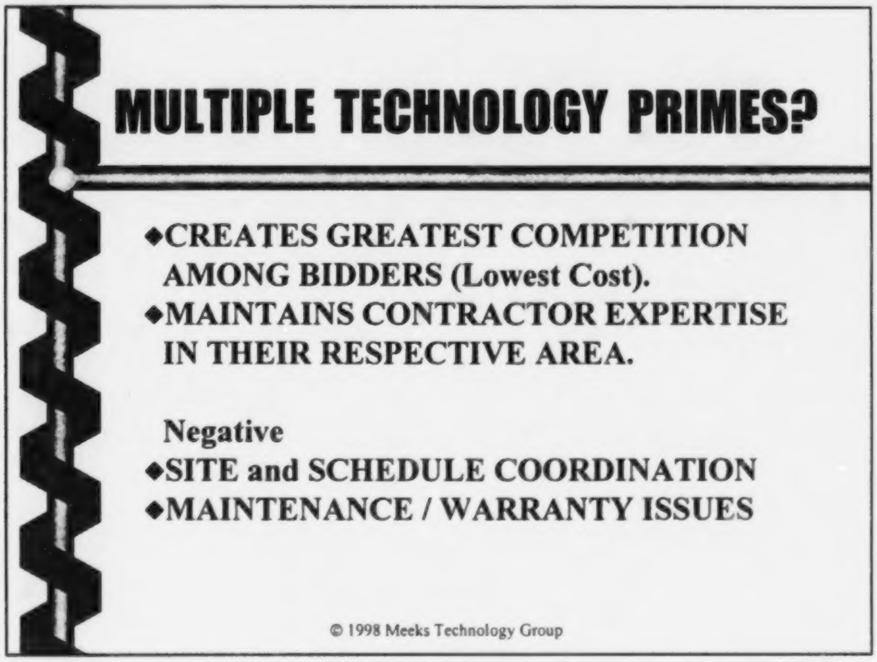


ONE TECHNOLOGY PRIME?

- ◆SINGLE POINT OF SITE COORDINATION
- ◆SINGLE POINT OF SCHEDULE COORDINATION
- ◆SINGLE POINT OF MAINTENANCE

Negative

- ◆SINGLE PRIME IS MORE EXPENSIVE THAN MULTIPLE TECHNOLOGY PRIMES
  (Prohibitive where contractors have no prior experience for combined bids.)

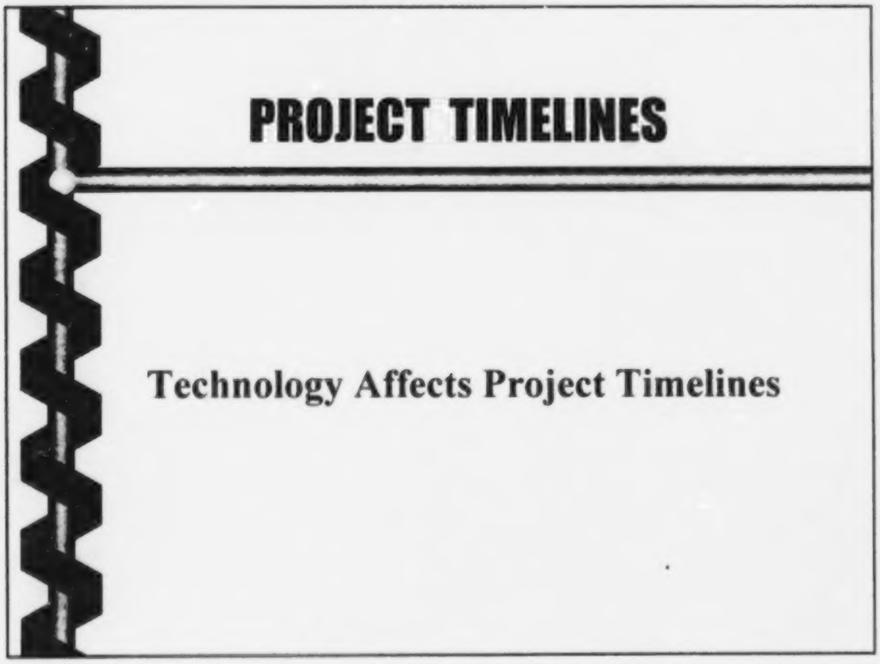


MULTIPLE TECHNOLOGY PRIMES?

- ◆CREATES GREATEST COMPETITION AMONG BIDDERS (Lowest Cost).
- ◆MAINTAINS CONTRACTOR EXPERTISE IN THEIR RESPECTIVE AREA.

Negative

- ◆SITE and SCHEDULE COORDINATION
- ◆MAINTENANCE / WARRANTY ISSUES



PROJECT TIMELINES

Technology Affects Project Timelines

THREE DISTINCT BID PACKAGES

- ◆INFRASTRUCTURE
- ◆TECHNOLOGY SYSTEMS and CABLING
- ◆COURSEWARE and LOOSE EQUIPMENT

INFRASTRUCTURE

- ◆AC Power
- ◆HVAC Needs
- ◆Raceways and Conduit

Part of the Architectural/Engineering Process
Bids as Part of The General Trades

TECHNOLOGY SYSTEMS and CABLING

- ◆**Voice Network and Cabling**
- ◆**Video Network and Cabling**
- ◆**Data Network and Cabling**
- ◆**Audio Systems and Cabling**

Defined by an Owners' "Vision/Application" Process. Bids as a Distinct Package.

TECHNOLOGY SYSTEMS and CABLING TIMELINE

- ◆**Should Bid No Earlier Than Twelve Months No Later Than Six Months Prior To Implementation Use.**

Provides As Close to Current Technology As Possible

Elementary Schools - Bid w/ General Trades
Middle Schools - Bid Separaetly and Later
High Schools - Bid Separately and Later

COURSEWARE and LOOSE EQUIPMENT

- ◆Computers and Printers
- ◆Computer Software
- ◆Audio/Visual Courseware
- ◆Computer Reference Sources (CD-ROM)
- ◆Library Automation System
- ◆Applied Technology Labs

Bid as separate packages by owner. Bid four months prior to implementation.

BID PROCESS

Packaging The Bid Proposals

BID PACKAGE ISSUES

- ◆BID PROPOSAL FORMAT
- ◆VENDOR and MANUFACTURER QUALIFICATIONS
- ◆TOOLS FOR THE OWNER

BID PROPOSAL FORMAT

- ◆"REQUEST FOR PROPOSALS" Format
- ◆"FUNCTIONAL" Specifications
- ◆"PROPRIETARY" Specifications

REQUEST FOR PROPOSAL

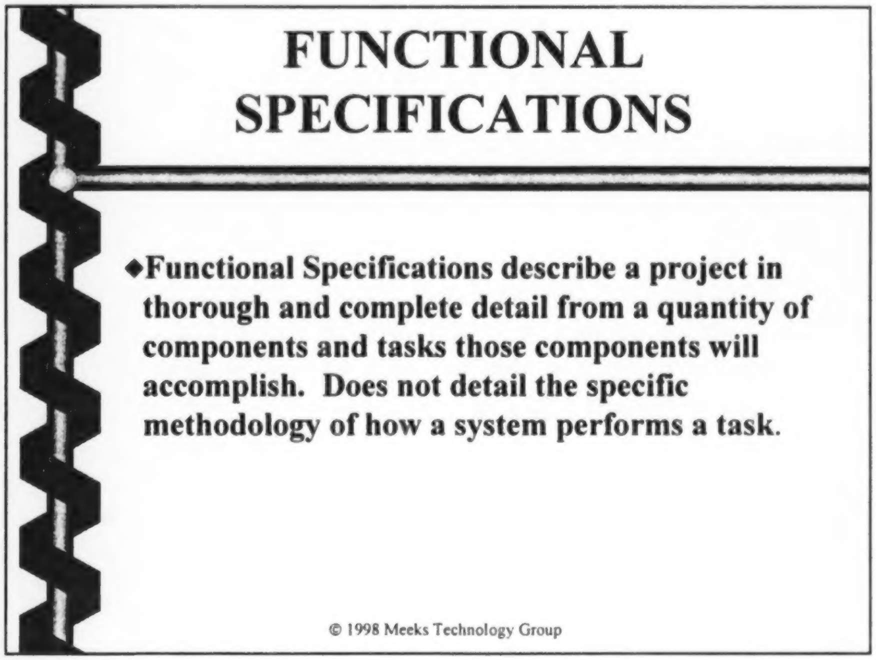
- "Request for Proposals" describe a project in generic terms. It outlines basic system performance requirements and provides a listing of tasks the system must be capable of performing.

POSITIVES

- Provides the Owner With Greatest Flexibility for Choosing Vendor.
- Provides for Greatest Vendor/Mfg Creativity for System Solutions
- Allows for More Voluntary Alternates and Value Engineering Proposals

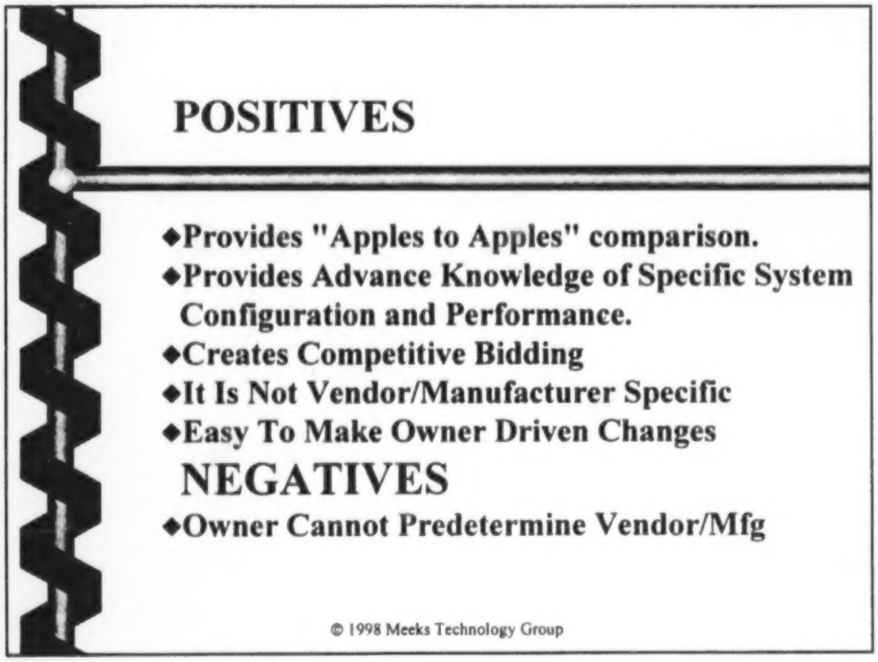
NEGATIVES

- Apples and Oranges Comparisons
- May Not Be Legal in Your State



FUNCTIONAL SPECIFICATIONS

- ◆Functional Specifications describe a project in thorough and complete detail from a quantity of components and tasks those components will accomplish. Does not detail the specific methodology of how a system performs a task.



POSITIVES

- ◆Provides "Apples to Apples" comparison.
- ◆Provides Advance Knowledge of Specific System Configuration and Performance.
- ◆Creates Competitive Bidding
- ◆It Is Not Vendor/Manufacturer Specific
- ◆Easy To Make Owner Driven Changes

NEGATIVES

- ◆Owner Cannot Predetermine Vendor/Mfg

PROPRIETARY SPECIFICATIONS

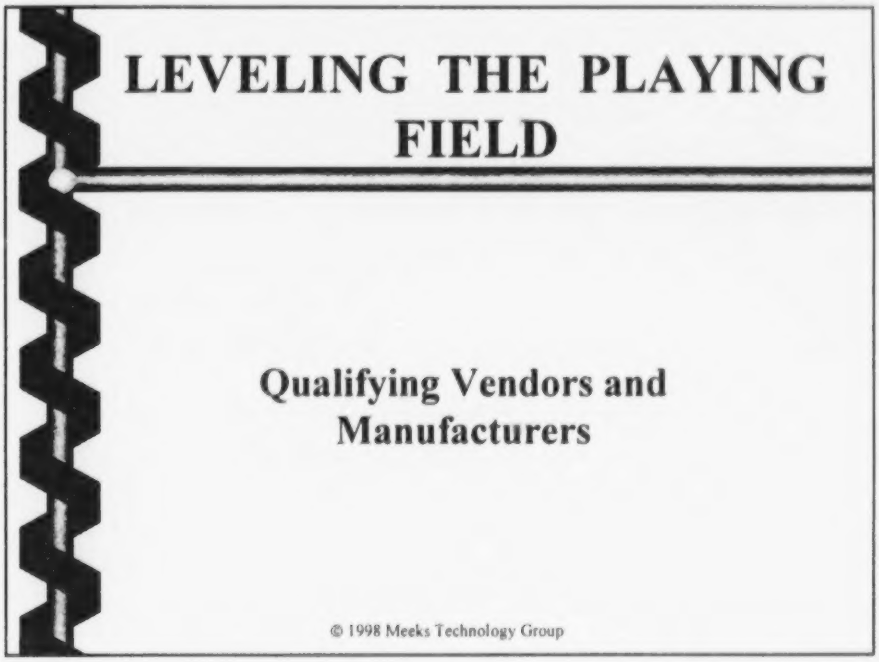
- Proprietary (or Performance) Specifications describe a project in thorough and complete detail. Operational methodology is rigidly described, the performance parameters and quantities of each component within that methodology are rigidly described.

POSITIVES

- Provides "Apples to Apples" comparison.
- Provides Advance Knowledge of Specific System Configuration and Performance.
- Allows Owner to Pre-Select Vendor/Mfg

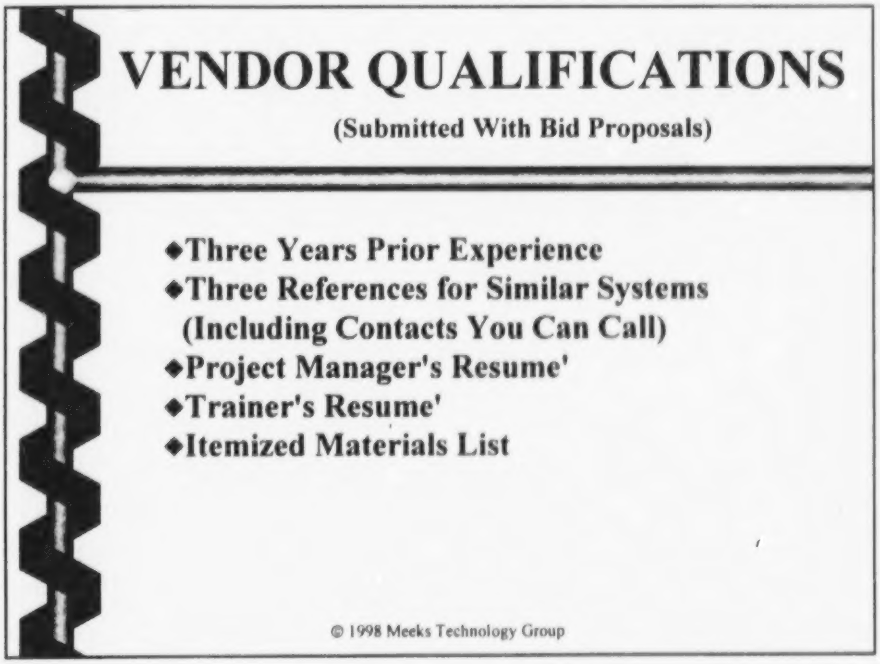
NEGATIVES

- Typically Vendor/Manufacturer Specific
- Inflexible System Configuration - Hard to Implement Owner Driven Changes
- Does Not Enhance Competitive Bidding



LEVELING THE PLAYING FIELD

Qualifying Vendors and Manufacturers



VENDOR QUALIFICATIONS

(Submitted With Bid Proposals)

- Three Years Prior Experience
- Three References for Similar Systems (Including Contacts You Can Call)
- Project Manager's Resume'
- Trainer's Resume'
- Itemized Materials List

MANUFACTURER QUALIFICATIONS

(Submitted With Bid Proposals)

- ◆**Project List**
- ◆**Special Features**

  Require a project reference for each special feature required for the system. If manufacturer does not have reference but claims they can meet the special feature, add a $250/day penalty clause tied to a specific date.
- ◆**Normal Features**

  $500/day penalty clause for claiming meeting specification requirements but actually fall short .

TOOLS FOR THE OWNER

Issues Addressed Through The Specifications

GENERAL

- ◆Tie Contract To General Trades Requirements Contract Procedures, Project Procedures, Scheduling, Trades Coordination, Pay Request Procedures
- ◆Require Technology Contractor To Review and Coordinate the Technology Raceways/Conduit
- ◆Provide Two Years of Warranty With Bid
- ◆Detail Training Requirements

VOICE NETWORK

- ◆Vendor Loads System Database Information
- ◆Vendor Programs Initial Switch Operation
- ◆Vendor Programs Initial Voice Mail Operation
- ◆Train Local Building "System Administrators" Who Implement Standard System Changes
- ◆Have Vendor Fund "Dial Up Data Services" Through Their Contract

VIDEO NETWORK

- Vendor Loads System Database Information
- Vendor Programs Initial Operation
- Train Operator and Users On Actual Instructional Usage, Not System Operation
- Modem Access to System By Manufacturer
- Have Vendor Fund Contests For Best Instructional Program By Teacher & Students

DATA NETWORK

- Vendor Loads System Database Information
- Vendor Provides CNE (Certified Network Engineer) For System Start Up
- Vendor Sets Up Computers / Printers
- Vendor Programs Initial Operation
- Modem Access to System By CNE
- CNE Is Provided As Part of Two Year Warranty

UNIVERSAL SERVICE REPORT and ORDER
(Universal Service Fund or E-Rate)

Meeks Technology Group clients are extremely interested and excited about the newly create technology funding mechanism available from the Federal Communication Commission (FCC). This report is being generated in an attempt to assist our clients understand the intent and status of the fund.

The US Congress created and passed the Telecommunications Act of 1996 that included Section 254,a tax on the local phone companies in the United States. Additionally, Section 254 stated that the FCC would generate a mechanism for distributing the revenue generated from that tax to eligible (eligibility defined by the FCC) schools and libraries. The FCC uses the phrase "Universal Service Report and Order" to describe the mechanism developed by the FCC to implement Section 254. The Order, adopted May 8, 1997, states schools and libraries would be eligible for $2.25 billion per year in discounts towards the purchase of telecommunication services and internal connections for Internet and Distance Learning access. The fund that the revenue generated by the tax is placed into is called the Universal Service Fund. The discounted rate is known as the Education Rate (E-Rate). Funds are available for discounts starting January 1, 1998. (Unfortunately, the process of application is not in place at this time, therefore, MTG seriously questions the ability to receive, judge, and award applications by this date.)

> **NOTE** - The local phone companies filed suit against the FCC earlier regarding the tax. The gist of the suit is that most state governments and their agency that determines policy for Public Utilities have already required the local phone carrier to offer discounted circuits rates to schools. Therefore, if the FCC requires the same local phone companies to also pay taxes which in turn are used to subsidize local school circuits costs, the local phone company would be double taxed. An out of court settlement was reached last Thursday, December 19, 1997, which reduced the tax on the local phone carriers by $600 million. MTG is attempting to confirm this statement and whether the $600 million relief is a one-time or annual item.

The FCC released an erratum correcting the Order on June 4, 1997, and released an Order on Reconsideration on July 10, 1997. MTG desires to emphasize the point that this Order is a *work-in progress* and is subject to more interpretation and clarifications. Additional Orders have been released that provide additional definition to the program. There is a temporary Fund Administrator, The National Exchange Carrier Association until a permanent one is appointed.

DISCOUNT RATE

Individual schools, school districts, libraries, and consortia comprised of those organizations are eligible. The E-Rate discount for eligible schools or districts is based in the Economic Disadvantage and Geographic Location of the school or district. The discount rate can be applied on either a district-wide or individual school basis.

The number of students eligible for the national school lunch program determines the Economic Disadvantage. This number can be determined by actual count or Title 1 alternate mechanisms.

The Office of Rural Health Policy of the Department of Health and Human Services has categorized areas as either rural (high cost) or urban (low cost). Rural areas are allowed a greater discount.

The actual Discount Schedule is as follows:

Discount Matrix

How Disadvantaged	**Urban**	**Rural**
%of students eligible for national school lunch program	%	%
<1%	20%	25%
1-19%	40%	50%
20-34%	50%	60%
35-49%	60%	70%
50-74%	80%	80%
75-100%	90%	90%

SERVICES ELIGIBLE FOR E-Rate

Telecommunication Services

All voice or data telecommunication services commercially available to schools. Examples include:

- Ordinary telephone lines for calls to teachers in classrooms.
- Integrated Digital Services
- Satellite delivery for distance learning.
- Coaxial cable.
- Network lines to connect to information services.
- Private lines between eligible acquirers (your own WAN)
- Pagers for security and officals

Internet Access

Services required to access the Internet are available for discounts. This includes:

- E-mail and Basic access to World Wide Web
- Includes data links and additional associated services needed for classroom access to the Internet (i.e. 56K Leased line, ISDN, fractional or full T-1, frame relay, ATM, etc...) This essentially covers the WAN connecting all of a district's facilities.

Paid subscriptions to Internet Service Providers and voice mail are not eligible.

Internal Connections

Basic installation and maintenance of a network are eligible for discounts. The internal connections must be necessary to transport information (Internet or Distance Learning information) within the school to individual classrooms. Example of eligible items:

- Cabling system.

- Hubs and switches.
- Routers
- Network File Servers
- Software needed for operation of file servers.
- Wireless Local Area Networks

Personal computers used solely as switches or file servers are eligible for discount.

Bundled Services

Internet Access bundled as part of a combined procurement. Eligible content categories"

- Content otherwise available free of charge.
- Content separately available (but supported at a difference between the bundled price and the price for the content alone.)
- Minimal content (if not offered separately and affirmatively shown that it is a more cost effective means of securing basic conduit access, but only non-content portion supported.)

It is Meeks Technology Group recommendation that clients pursue discounts for one time type of expenditures. Success in applying for discounts through the USF do not automatically transfer from one year to the next. Therefore, annual fee services secured under the discount in 1998 may not be funded in 1999. However, we suggest that should a District determine that they wish to pursue discounts on annual fee services, the Board of Education should be involved in the process. The Board should be made aware of their exposure to funding changes in subsequent years that will require accommodation within future yearly district budgets.

ELIGIBLE CONTRACTS

When the conditions of the fund were first announced earlier this year, projects involving eligible services and slated for implementation in 1998 but already under contract, were not eligible. Due to the tardiness of establishing the USF approval process, this issue has become a moving target. The review board acknowledges that there are a number of projects that may already be contracted for that would have been eligible if the Fund approval process had been in place. It appears that projects already under contract but bid in the latter months of 1997 can apply for funds. Those applicants will need to submit all of the required documentation but will skip the 28-day bid period and submit Form 471 along with Form 470. The specifics regarding approval for these projects have not been defined.

APPLICATION PROCESS

The application process is directly tied to the operation of a FCC Web Site where all application forms will reside and all applicants are to submit their documents to. That Web site was originally scheduled to be on-line in October 1997. That date has been moved to mid November, then to mid December, and is now slated to be on-line January 12, 1998.

NOTE: Considering the information required for application that is outlined in the following sections, MTG has serious doubts of the Web Site capacity to handle this application process. Therefore, MTG is scheduling a trip to Washington DC in December with a number of MTG client application packages. It is MTG's intent to gain approval from the Fund Administrator for MTG's specific methodologies and processes in order to streamline our clients Fund applications.

The following items must be submitted to the Fund Administrator.

1. *Certification* signed by the institution's procurement officer as to the level of discount based on economic need using the discount matrix.

2. *A Technology Plan* approved by an independent agency (such as State education or agency or other reviewer). Personnel related to the overall program have suggested that approval of the Technology Plan by the local Board of Education will suffice for this requirement. MTG has not been able to obtain a definitive statement on this issue. The Technology Plan must include:
   A. Computer equipment currently available or budgeted for purchase.
   B. Internal connections, if any, a school already has or anticipates installing.
   C. Software for LAN and telecommunication connections currently available or budgeted.
   D. Experience and training of staff in the use of the equipment.
   E. Existing or budgeted maintenance contracts to maintain computers.
   F. Capacity of the school's electrical system to handle simultaneous uses.

   Additionally, schools must prepare a specific technology plan outlining the use of technologies, in the near term and future, and how the institution intends to integrate the use of technology with their curricula.

3. *A Description of Service* sought in sufficient detail so providers can bid on the services. We consider these to be the project specifications.

4. *The Amount of Funds* necessary to meet the financial obligations of the technology plans (including necessary hardware, software, and staff training) committed (budgeted and approved in time for use for this project) for the current funding year. The District must also certify that these funds are available.

5. *Additional Certifications*
   A. That the institution is eligible to receive discounted services.
   B. Those discounted services will not be resold and will be used only for educational purposes.
   C. The applicant has and will continue to comply with all applicable State and local procurement processes.
   D. Identification of all co-purchasers and allocations of services in aggregated purchases.

   Due to the lateness of availability of the appropriate Web Site, the Fund Administrator and FCC has determined that for the first 75 days of application availability, all applications will be equally considered, not simply "first come-first serve." This is vitally important in that there are very large school systems (i.e. New York City Schools) standing by with very large applications that could pull most of the funding available into a few large districts.

6. *Application Form*
All of the information above must be accompanied with Form 470, the actual application form available in draft form on the E-Rate information site.

NOTE 1: We have reached the first major problem point, there is no definition as to how the approval process works. Documents available imply that if the Fund Administrator posts an applicant application on the Web Site, that represents approval of that application but no guarantee of funding.

POSTING for BIDS

The Fund Administrator will post the application, including the description of services sought to attract bids. The actual discounts will be calculated by the Fund Administrator and posted with the application. There will be a four-week waiting period after posting (28 days) before the applicant can enter into a contract with the service provider.

NOTE 2: Please note that the posting of an applicants request for services does not imply that the funding has been approved. Approval of amounts and actual encumbering of fund occurs after receipt of contract values. We would also like to state that we see the process of posting the request for services on the WEB as untenable. We believe that the E-Rate WEB site will only provide an abstract of the services requested. It would be impossible to post the specifications and project drawings to a WEB site due to the size of the storage requirements and interface problems for obtaining project drawings of the correct size. MTG does intend to post their client projects on the MTG file server,*meeksgeeks.com.*

COMMITTEMENT OF FUNDS

Funding requests base on actual contract values will be submitted to the Fund Administrator on Form 471 (also available in draft form at the E-Rate WEB Site) by schools after the contracts are made, but the contract may be contingent on receiving funding. If sufficient funds remain, the Fund Administrator commits them and notifies the service acquirer (the contractor), that funding has been committed. The Fund Administrator also posts the commitments on weekly basis to their WEB server.

OVERVIEW OF APPLICATION PROCESS

Therefore, the sequence of application includes the submission of Form 470 and applicable documents, the advertisement for services on the WEB for 28 days, negotiation or determination of contract values, and the submission of Form 471. These four activities comprise the entire application process. Since then process includes contract value negotiation, it would typically also include approval of those same contracts by the Board of Education. (Note that approval of contracts by the Board of Education is not required in order to submit Form 471) Please keep these activities in mind when attempting to establish project time lines involving E-Rate funds.

NOTE 3: The original conditions of the USF stated that yearly funds would be allocated on a first-come first–served basis until $2 billion in funds were encumbered. At that point, applications from economically disadvantaged (most needy) locations would be processed until the money runs out. Based on comments from users, an FCC Order was issued in October requiring the Fund Administrator to treat all 1998 applications occurring in the first 75 days of application as if they came in all at the same time. With the first date available for posting service requests to the WEB server on January 12, 1998, MTG estimates the latest date an application can be initialized yet considered within the first 75-day window should be considered as February 25, 1998. That provides the applicant 28 days of bid request advertisement and five days to process Form 471.

AVAILABILITY OF E-RATE FUNDS

QED, a marketing information provider who concentrates on the education market, estimates the technology based expenditures for K-12 School Districts to range between $4.5 and $6 billion per year. This includes computers and software for those computers. MTG finds that the typical fund allocations of K-12 School District to have a very high percentage of funds spent on computers. Therefore, we estimate that the actual funds spent on cabling system, network hardware, routers, Wide Area Network products, phone systems, and telecommunication services to be $1.5 to $2 billion per year. Our points is that the funds available from the USF essentially double the revenue available for these services and are tied directly to actual funds being available to school districts or libraries. We find it unlikely that all of the USF will be encumbered within the first 75-day window. Therefore, we recommend that all of our clients with projects occurring after March 1, 1998 to continue to apply for E-Rate funds.

CERTIFIED CONTRACTORS

Only those contractors who are certified as "E-Rate" contractors can participate in receipt of E-Rate funds. To the best of our understanding, the certification process is to simply sign a document that states the contractor is willing to be paid through the "E-Rate" funds and is willing to wait for those payments.

PAYMENT PROCESS

Schools will process E-Rate eligible payment applications in a format (yet to be determined), that separates the schools funding obligation and the discount applied to the payment request. The school will process their portion of the payment and forward a copy to the Fund Administrator. The Fund Administrator will then process payment for the E-Rate contractor. At this time, there is no definition on the duration of a pay period (monthly or quarterly).

AUDITING

Schools will be required to maintain appropriate records necessary for future audits and to produce them upon request to any auditor appointed by the Fund Administrator or any other State of Federal agency with jurisdiction.

This document has been generated with the intent of notifying MTG clients of additional funding sources available for their use and a general understanding of how to access those funds. The information contained herein is accurate to the best of the knowledge of Meeks Technology Group (MTG) up to the time that this document was generated. In view of the evolving nature of the USF/E-Rate application process, the information contained herein may be rendered obsolete or inaccurate based on future FCC Orders and interpretations by the Fund Administrator. Additionally, the information contained herein has been obtained from multiple sources. Though MTG is attempting to verify all interpretations and process descriptions, MTG takes no responsibility for the accuracy of those sources.